THE

PHYSICAL DIAGNOSIS

OF

DISEASES OF THE LUNGS.

BY

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TO

SIR JAMES CLARK, BART. M.D. F.R.S.

PHYSICIAN IN ORDINARY TO THE QUEEN
AND TO THE PRINCE ALBERT.

My dear Sir James,

The pleasure I proposed to myself in dedicating this little volume to you, added in no small degree to the agreeableness of my task in composing it. The services you have rendered the art of Physical Diagnosis, both by precept and by example, give you an especial claim to the dedication of any work written with the desire of facilitating its study and practice. And I have a personal motive, no less strong than this professional one, for offering you these pages; that of acknowledging my sense of obligation to the ready kindness of your counsels and the disinterested warmth of your friendship.

I am,
My dear Sir James,
Most sincerely yours,
W. H. Walshe.

Upper Charlotte Street, Fitzroy Square,
November, 1842.

PREFACE.

I HAVE endeavoured, in the following pages, to present a complete though concise view of the principles and facts of Physical Diagnosis, as applied to diseases of the respiratory organs. In the First of the three Parts, into which the work is divided, the various methods of physical examination, and the phenomena detected by them in the states of health and of disease, are described. In the Second Part will be found a tabular view of the physical causes and ordinary seat of all morbid signs, in connection with the names of the diseases in which they occur; and also a synopsis of the signs attending each affection of the lungs, pleura, and larynx. The Third Part forms a commentary upon the two preceding. By excluding from the descriptive portion any discussion upon debateable points, and in the tabular views by distinguishing with a different type the more striking phenomena from those less constantly useful and available in practice, I have, I trust, succeeded in adapting the book for beginners. The attention bestowed upon them in the commentary will,

however, show that I do not undervalue delicate signs: far from this, I know by experience that in many instances apparently trivial phenomena will justify a diagnosis that without their aid had been altogether unwarrantable.

I have avoided, as far as possible, all disquisition upon the acoustic principles regulating the production and transmission of sounds; not on account of any deficiency of interest or importance in the subject, but because I was unwilling to increase the size of the book, or deprive it of the simply practical character I had aimed at giving it.

I believe I am correct in mentioning as a distinctive feature of this little volume, its being the first elementary work in which all the methods of physical examination are considered with the care to which they are severally entitled. If Laennec had the excuse of a discoverer for his almost exclusive and certainly over-weening attachment to Auscultation, as compared with other methods of Physical Diagnosis, his followers can offer no such brilliant apology for perpetuating, as they have too generally done, his unquestionable, and almost solitary, error.

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PART II.

PART III.

ERRATA.

Page 36. line 13. for " amount " read " moment."

57. lines 9. and 14. for " § 250." read " § 165."

The figures enclosed in brackets, and marked thus [§], refer to the paragraphs in the Commentary.

THE

PHYSICAL DIAGNOSIS

OF

DISEASES OF THE LUNGS AND LARYNX.

INTRODUCTION.

The existence of disease involves that of physical change, not only in the part originally and chiefly affected, but also in the structures immediately adjoining. There are a few apparent exceptions to this statement; but, admitting their reality, they are of such slight importance as scarcely to affect the general proposition. [§ 1.]

The physical changes thus arising may or may not be capable of accurate discrimination during life. When they can be so discriminated, experience has shown that their detection is not so much accomplished by means of the vital functional derangements of the organs implicated, as by the aid of various alterations in the physical properties or actions of those organs,—as, for example, their density, their faculty of generating and of transmitting sound, &c. So invariably do these alterations bear a certain and fixed relation to the nature of the disease with which they are associated, that their discovery is conclusive as to the existence of given textural maladies. And not only the nature,

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but the precise limits and the precise degree of these maladies are disclosed by the alterations referred to, which, for these reasons, constitute their *Physical Signs.* Physical signs are, then, the true revealers of the nature, extent, and degree of organic affections, and may be regarded as the means or instruments of pursuing morbid anatomy on the living body.

The means by which the existence and nature of physical signs are discovered, are called *Physical Methods of Diagnosis;* and these methods vary with the properties, position, and functional relations of the organs examined.

The diseases of the respiratory organs are among those of which the physical *signs* are best understood and most readily ascertained; the *methods* employed in their detection are:—

I. Inspection;

II. Application of the Hand;

III. Mensuration;

IV. Percussion;

V. Auscultation;

VI. Succussion.

These methods are, as nearly as is possible, applied to the organs themselves of which we desire to ascertain the condition,—to the external surface corresponding to them, when inapplicable to themselves. But the absence or presence of disease in the lungs, and, if it exist, its nature, may sometimes be indirectly inferred by employing these methods in

VII. The Determination of the Situation of surrounding Parts and Organs,—

which may consequently be considered an additional method of physical diagnosis. [§ 2.]

All these methods agree in the general character of their direct and indirect objects. The *direct object* the physician has in view with all is the just appreciation of the sensations they furnish, and these are nothing more than the physical signs already spoken of; the *indirect object* the reference of these signs to the anatomical states upon which they depend.

The general description of each of these methods must comprehend an inquiry into:—1. Its nature; 2. Its direct or immediate object; 3. The manner of practising it; 4. The conditions which are discovered by its means in the healthy state; 5. Such deviations from the ordinary standard of these conditions as are nevertheless compatible with health; 6. The deviations from that standard which are actually pathological and constitute signs of disease.

The different methods are described in the following pages precisely upon this plan, and in the order in which they have already been enumerated. In employing them at the bed-side the same order should be followed.

PART I.

GENERAL DESCRIPTION OF THE METHODS OF PHYSICAL DIAGNOSIS.

Sect. I.—Inspection.

By inspection of the chest, as a method of physical diagnosis, is understood simply the ocular examination of its external surface; by it are ascertained the conditions of exterior *form* and *size* of the cavity, and of the *motions* of its walls. The *form* of the chest is to be considered in respect of its *general configuration*, and the *shape of its various parts.* The *size* of the cavity is less important considered as a whole, than as composed of two divisions; the relative dimensions of these being the point of real consequence. The *motions* of the chest are *general* and *partial:* the *general* motions being those of *expansion* and of *elevation;* the *partial*, consisting of a *movement of the ribs in respect of each other.*

In order to ensure correct results from inspection of the chest, the following precautions are to be observed:—that the light be good; that the surface examined be fully exposed; that the patient's muscles be relaxed, and all physical restraint removed: and above all, that the plane on which he lies, stands, or sits, be perfectly even. When the patient's state allows the observer the choice of the three postures just mentioned, the sitting ought decidedly to be directed. Inspection should be practised anteriorly,

posteriorly, laterally, and from above downwards. Inspection in the latter direction is particularly to be employed, as a means of ascertaining the antero-posterior diameter of the chest, when callipers cannot be had. [§ 3.]

Under all circumstances, it is of the last importance, in performing inspection, that the two sides of the chest, both generally and in their various corresponding parts, be closely *compared.* This observation applies with the same force to all other methods of physical examination; without *comparison* of corresponding regions the utility of this kind of investigation would be incalculably diminished. [§ 4.]

In order to give precision to the description of the different parts of the chest, its surface has been divided into artificial regions; but as the assignment of limits to these regions is altogether arbitrary, it is not to be wondered that the boundaries adopted by different writers vary. Simplicity, as far as is compatible with the main object in view, should be especially aimed at in all such topographical arrangements; but it does not appear to me possible, without incurring the chance of error, to make the number of divisions less than in the following table. The sub-regions marked thus * are single; all the rest are double.

Regions.	*Sub-regions.*	
a. Anterior.	1. Post-clavicular.	
	2. Clavicular.	
	3. Infra-clavicular.	
	4. Mammary.	
	5. Infra-mammary.	
	6, 7. Sternal.	6. Upper.*
		7. Lower.*

Regions.	*Sub-regions.*	
b. Posterior.	8, 9. Scapular.	8. Upper.
		9. Lower.
	10 Infra-scapular.	
	11. Interscapular.	
c. Lateral.	12. Axillary.	
	13. Infra-axillary.	

The boundaries of these sub-regions, stated with as much brevity as possible, are as follow:—

1. *Post-clavicular.*—Above, the edge of the trapezius muscle; below, the clavicle; outside, the head of the humerus; inside, the base of the neck.

2. *Clavicular*, corresponds precisely in its outline to the clavicle.

3. *Infra-clavicular.*—Above, the clavicle; below, the third or fourth rib; outside, the outer edge of the deltoid muscle; inside, the edge of the sternum. [§ 5.]

4. *Mammary.*—Above, the third or fourth rib; below, the seventh or eighth; outside, a line vertically drawn about an inch and a half external to the nipple; inside, the edge of the sternum.

5. *Infra-mammary.* — Above, the seventh or eighth rib; below, a curved line corresponding to the edges of the cartilages of the false ribs; outside, as the mammary sub-region; inside, the margin of the lower fourth of the sternum.

6, 7. *Sternal*, corresponds precisely to the sternum; the *upper*, to its superior two thirds; the *lower*, to its inferior third.

8, 9. *Scapular*, has the same limits as the scapula; the *upper*, corresponds to the supra-spinata fossa, the *lower*, to the infra-spinata fossa.

10. *Infra-scapular.*—Above, a line drawn transversely on the level of the angle of the scapula; below, a similar line on the level of the twelfth dorsal vertebra; outside, a line falling vertically downwards from the lower part of the outer border of the scapula; inside, the spine.

11. *Interscapular.*—Above, a line drawn from the spine of the scapula to the vertebræ; below, a line passing inwards from the angle of the scapula; outside, the inner border of that bone; inside, the spine.

12. *Axillary.*—Above, the angle of the axilla; below, a line drawn transversely about two inches below the level of the nipple; anteriorly, the line bounding the mammary sub-region outside; posteriorly, the external border of the scapula.

13. *Infra-axillary.*—Above, the lower edge of the axillary sub-region; below, a line corresponding to the edge of the false ribs; anteriorly, the external border of the mammary and infra-mammary sub-regions; posteriorly, the external border of the infra-scapular sub-region.

Results of Inspection in the Natural State.

A. *Form.*—The form of the chest of subjects who have never had any affection of the thorax itself or its contents may be *regular*, or more or less *irregular*. [§ 6.]

A chest *regularly* formed presents to the eye a cone having its narrow end uppermost [§ 7.]; its transverse diameter plainly exceeding the antero-posterior; its two sides symmetrical, both generally

and in their different parts; the post-clavicular spaces very slightly depressed; the lower part of the sternal region hollowed out in proportion to the stoutness of the subject; the infra-clavicular sub-regions gently convex [§ 5.]; the intercostal spaces visible in inspiration and expiration, unless the individual be too fat; the lateral surfaces of the chest equally distant from the median plane,—as likewise the nipples, which are both on the same level, that of the fourth rib or fourth intercostal space; the different regions of the chest, considered in themselves, regularly shaped; the shoulders on the same level; the spine deviating neither anteriorly nor laterally, and the vertebral sulcus, moderately convex from above downwards, more or less deep according to the fatness or thinness of the individual.

Irregularly formed chests, in which no disease has ever existed.—It is comparatively rare to find a chest having in all respects the characters above enumerated; certain deviations of form, perfectly compatible with health, both of the system generally, and of the subjacent organs, are of extremely common occurrence. These deviations of form, which may be congenital or acquired, must be carefully distinguished from those produced by disease; their varieties and proportional frequency are shown elsewhere. [§ 8.]

These deviations of form compatible with health ("physiological," or non-pathological heteromorphisms,) may be general or partial. The *general* are those in which the natural relations of the different diameters of the chest are altered; the *partial*,

consist of local defects of symmetry, having no influence on the general shape of the thorax.

Certain heteromorphisms may be either non-pathological in the manner above defined, or they may be the consequences of disease, and therefore pathological. When a deviation of form, which may be thus either morbid or not, presents itself, its character in this respect can only be determined by the absence or presence of other signs denoting subjacent disease, or by the previous history of the individual showing that he has or has not suffered from pectoral complaints. [§ 9.]

General heteromorphism is excessively rare as a *non-pathological* state,—an important circumstance for consideration in deciding in any instance upon its character. [§ 10.]

It follows from what has been said, that there are some heteromorphisms which occur only as non-pathological states, others only as pathological, while a third set may belong to either description according to circumstances. The distinction of these three classes is of the greatest importance; and in order to facilitate it as much as possible, a table is appended giving lists of the changes of form usually belonging to each. [§ 11.]

B. *Size.*— No positive rule can be laid down respecting the natural dimensions of the thorax in proportion to that of the body generally: the proportion varies in different individuals enjoying robust health.

There is no *visible* inequality of size in the two sides of a well-formed thorax. [§ 12.]

C. *Motions.*— The motions of the chest which

are of importance in a clinical point of view, are *general* and *partial.*

a. The *general* motions, or those in which the entire thorax is concerned, are of *expansion* and of *elevation.* In health these two kinds of motion are so intimately associated and agree so closely in proportional amount, that it is unnecessary to consider them separately; in certain states of disease, however, they are observed to be very differently affected.

During inspiration the walls of the chest move outwards from their central axis (*expansion*) and at the same time rise upwards (*elevation*). These motions are regular in rhythm, more marked at the lower than the upper parts of the chest [§ 13.], perfectly similar on both sides, and correspond to the enlargement of the lungs. The rapidity, the energy, and the extent of these movements bear a direct proportion to each other under all circumstances of health; but the absolute amount of all three varies within certain limits in different individuals.

During expiration the walls of the chest are restored to their previous condition by the converse movements of *retraction* and *depression.*

In each act of respiration the motions of expiration follow those of inspiration so closely, that no distinct pause is perceptible between them; when expansion and elevation cease, retraction and depression appear to begin, precisely as the audible pulmonary sounds by which they are accompanied. [*Vide* p. 48. and § 61.]

If the entire time occupied by a respiratory act,— that is, from the beginning of one inspiration to the

beginning of the next,—be represented by 10, the value of the duration of the inspiratory movement may be estimated approximatively at 5, of the expiratory at 4, and of the pause between the expiratory and succeeding inspiratory movement at 1. [§ 13.]

In health, the *extent* and *frequency* of the motions of the thorax respectively regulate, or, at least, bear a direct proportion to, the *duration* and *intensity* of the pulmonary respiratory murmurs.

b. The *partial* motions of the chest are those of the ribs upon each other. During inspiration these bones rise upwards, and separate somewhat from each other (in other words, the intercostal spaces widen); during expiration they become proportionally lowered, and approach nearer to each other. In these movements there is apparently some degree of torsion of each rib.

In health, the freedom and extent of these partial movements bear a direct proportion to those of the general thoracic motions; they are more marked in very young subjects than in adults, in these than in persons of advanced age.

Morbid States discovered by Inspection.

A. *Form.*—The different changes of form (heteromorphism) and of position (heterotopia) of the whole chest or of its parts, which may announce subjacent disease, are referrible to the following species [§ 14.]:—

Expansion and Bulging.
Retraction and Depression.

Procidentia and Elevation.
Curvature.
Distortion.

Expansion signifies a change of shape of the chest, in which one or both of its sides is generally prominent; *bulging*, a local or circumscribed expansion, the remainder of the surface being either in the natural state or affected with some other species of heteromorphism.

Retraction and *depression* are the converse states of expansion and bulging; the former, a general sinking of the walls on one side, the latter, a similar condition limited to one spot or region.

Procidentia is that state in which the position of a part is slightly lower than natural; *elevation*, that in which it is higher.

Curvature signifies that deviation of the various axes of a part in which some degree of regularity of form is retained; *distortion*, a displacement of the same kind fundamentally, but one in which the deviations are so numerous and so considerable that all trace of regular shape is lost.

B. *Size.*—Numerous deviations from the natural relative dimensions of the different parts of the thorax occur in consequence of disease; but as they are always to be more accurately estimated by measurement than by inspection, and in some cases only to be ascertained at all by means of the former, the consideration of their different varieties is deferred to the section on MENSURATION.

C. *Motions.*—a. *General.* These are liable to *diminution* or to *increase*; and to alteration of rhythm,

so that they become *jerking*, instead of being gradually and equably produced.

The *rhythm* of the *entire respiratory act* is likewise subject to change; the duration of the expiratory movements may become considerably greater than that of the inspiratory.

The relation of the motion of expansion to that of elevation may change completely; the former, for example, being almost totally suppressed, while the latter becomes even peculiarly obvious.

The proportion naturally existing between the extent and frequency of the general motions on the one hand, and the duration and intensity of the pulmonary respiratory murmurs on the other, may be altogether subverted; the former may be greatly increased in amount, while the latter have undergone remarkable diminution.

b. *Partial.*—The costal motions are liable to become greatly diminished in energy and extent, if not actually suppressed.

The proportion naturally subsisting between the energy and extent of the costal and the general motions may be altered; the former motions may be nearly abolished, while the latter have not undergone any very obvious diminution.

Fluctuation.—The movement of fluid contained in the cavity of the pleura may be distinctly perceived in some rare cases of considerable bulging of the intercostal spaces,—independently of perforation of the costal pleura, and escape of the liquid into the common cellular membrane. This is the only sign discovered by inspection, which is not a modification of some natural condition.

SECT. II.—APPLICATION OF THE HAND.

By application of the hand, is meant the act of laying the hand on the external surface of the chest. Its object is to ascertain the *form* of the different regions of the thorax (little or no information can be derived from it regarding the *general* conformation of the cavity); the state of the *general*, and especially of the *partial*, *motions* of the walls; the amount of *vibration* communicated to the hand from those walls, and the existence or absence of *fluctuation* in the cavity of the pleura.

In employing this method of diagnosis, the palmar surface of the fingers and hand should be laid gently and evenly on the surface. If the object be to investigate the form or motions of the thorax, this is the only precaution, in addition to those recommended for the proper performance of inspection, which it is necessary to observe; if the thoracic vibration be the subject of examination, it is advisable to place the patient in the horizontal position.

Application of the hand as a means of investigating the motions of the chest is of very limited utility; it is inferior in point of accuracy and ready employment to inspection, and can at the best do little more than confirm the results obtained by this latter method. In the state of health, the hand laid upon the surface receives the impression of a double series of movements occurring beneath; these are the partial and the general motions of inspiration and of expiration. Considerable practice is, however, required to enable the observer to distinguish the *general* from the *partial* class, and no particular

advantage is obtained by the capability of distinguishing them.

When a healthy individual speaks, a certain vibratile tremor (*vocal thoracic vibration* or *fremitus*) is transmitted to the hand applied to the surface of the chest. This vibration is extremely delicate under all circumstances, but is marked in proportion to the graveness of the speaking voice; stronger when the patient assumes the horizontal than any other posture (Fournet), and in thin than in fat subjects; more marked on the right than on the left side (Stokes, *On Diseases of the Chest*, p. 497.); in front than behind; behind than laterally; scarcely perceptible in the infra-clavicular, and still less so in the interscapular sub-regions (Fournet). It is stated to be unaffected by the tension or relaxation of the muscles.

It is absent altogether in persons with weak or shrill voices; hence almost invariably in children, and very frequently in women.

The act of coughing produces a similar vibration (*tussive*); but this is less easily detected and appreciated.

Morbid States discovered by Application of the Hand.

Alterations of form and of motion are ascertained to exist by application of the hand, as by inspection; it confirms the results obtained by the latter.

The diagnostic indications derived from *thoracic fremitus* or *vibration* depend upon modified states of the phenomenon as produced by speaking (*vocal*)

and by coughing (*tussive*), and also upon its occurrence under circumstances which do not give rise to it in health. Of the latter kind are the vibrations produced by the bubbling of air through fluids in the lung (*rhonchal*); by the collision and rubbing together of plastic matter exuded upon the pleural surfaces (*rubbing*); and lastly, by pulsation of the substance of the lung (*pulsatile*). These require separate consideration.

a. *Vocal.*—The natural fremitus produced by speaking is susceptible of *increase* or *diminution.* As in the case of other signs the amount of change existing is most effectually ascertained by comparison of the two sides of the chest; in making this comparison both hands may be applied at the same time, one to each side, or upon each side successively and repeatedly, at intervals of a very few moments, while the patient continues to speak uninterruptedly the same words in the same manner. It is scarcely necessary to add, that if either hand be more deficient in nicety of touch than its fellow, the latter only should be used. [§ 15.]

b. *Tussive.*—This species of vibration is liable to be affected in the same manner as the vocal.

c. *Rhonchal.*—The only rhonchus which, as far as my experience goes, is ever attended with a distinct sensation of fremitus on the surface, is the sonorous; and this only in some cases, when the rhonchus is of remarkable intensity. It is said by Laennec, that in very strong *death-rattle* a similar phenomenon may be detected.

d. *Rubbing.*—In the natural state of the pleura, the motions of its costal and pulmonary laminæ upon

each other gives rise to no vibration perceptible by the hand applied to the surface. Nor is it usual, even in cases where *audible* friction phenomena exist, to discover such vibration: in some instances, however, it may be detected; and the sensation conveyed, though distinctly somewhat vibratile, nevertheless possesses more of a simply rubbing character, just as might be anticipated from a consideration of its cause. When it exists, its intensity may be increased by causing the patient to breathe deeply; this will, indeed, suffice to produce it in some cases, where it had been imperceptible during ordinary respiration.

c. *Pulsatile.*—A pulsatile movement of the lung, attended with a sort of vibration of the surface, would appear to be sometimes perceptible upon the walls of the chest. It is isochronous with the pulsation of the heart. [§ 138.]

Fluctuation.—The fluctuation of fluids contained either in the pleura or lungs is sometimes distinctly perceptible by the hand applied to the surface. The sensation is that of ordinary fluctuation, attended (not always) with a certain degree of vibratile tremor. Its existence may be ascertained, either by the movements of the fingers used by surgeons for detecting fluid in an abscess (*simple fluctuation*); or it may be necessary to perform succussion of the chest (*fluctuation by succussion*); or percuss the surface in order to produce it ("*peripheric*" *fluctuation*); or it may occur spontaneously as an attendant on certain rhonchi (*rhonchal fluctuation*); in this latter case it is that vibration may be most distinctly felt. The "peripheric" species (described

by Dr. C. Tarral), is to be detected as follows:—give a quick sharp fillip in an intercostal space, perpendicular to the surface, and a sensation of fluctuation will be transmitted to a finger of the other hand firmly applied to the surface in the same space, at a short distance from the point percussed.

The *fluctuation* signs are all of them of very limited importance.

Sect. III.—Mensuration.

The object of measuring the chest is to ascertain more accurately than can be done by inspection and application of the hand, the comparative bulk and volume of the two sides, the relative positions of their different parts, and in some few instances, the distance between those parts and certain fixed points beyond the limits of the thorax. It is also employed as a means of estimating the amount of expansion and retraction of the chest accompanying inspiration and expiration.

A complete system of Mensuration would comprise the following admeasurements:—

A. General.

a. Circular.	1. *Opposite ensiform process.* 2. Midway between nipples and clavicles.
b. Transverse.	3. From point of one acromion to that of the other. 4. In axillæ. 5. At base of chest.
c. Antero-posterior.	6. *Under the clavicles.* 7. At base of chest.
d. Vertical.	8. *From clavicle to most dependant point of ribs.*

B. Partial.

a. Horizontal. 1. *From nipple to middle line of the sternum.*

b. Vertical.
- 2. *From sterno-clavicular articulation to nipple.*
- 3. From nipple to antero-superior spine of ileum.
- 4. From most dependant point of the twelfth rib to the same process.

But these different kinds of measurement are not all of equal importance, especially in the present state of knowledge,—either because some of them really convey information of very secondary value, or because they have not as yet been sufficiently practised to render the physician familiar with the indications derivable from them. The measurements which it is of real consequence for the student to understand, and in all doubtful cases to practise, are distinguished by italics: at the same time it would be a mistake to imagine that all the others may not occasionally furnish more or less useful information, either confirmatory or corrective of results otherwise obtained.

In performing Mensuration, the same precautions are to be observed in respect of the posture of the patient, as those directed in the case of Inspection. The manner of measuring and the instrument required vary according to the measurement to be made.

A. General Measurements. — a. *Circular.* 1. For circular measurement, the simplest and best instrument is an inextensible tape, such as is used by tailors, graduated by inches and quarters. Though less elegant than the metallic spring-box, with the tape coiled within, it has always appeared

to me the more manageable of the two. One of its extremities being accurately fixed on the middle line of the ensiform cartilage, the tape is evenly and horizontally brought round the chest to the same point, from right to left, closely but not tightly applied, care being taken that no crease or other irregularity interfere with its accurate apposition to the surface in all its parts. The total number of inches is then ascertained, while an assistant notes the exact point of the measure corresponding to the middle line of the spinal column. The number of inches found at the latter point gives the width of the right side of the thorax, and by subtracting that number from the total amount, the width of the left division is at once obtained. While the measurement is made, the patient should be desired to hold his breath, so as to obviate any inaccuracy which might result from the movements of the chest. [§ 16.]

In ordinary calm respiration the dilatation of the thorax exercises scarcely any effect on the measured width: in full-chested persons ordinary inspiration produces an enlargement amounting to about an inch. That this dilatation affects both sides equally is rather matter of inference than of actual observation.

The mean circular capacity of the chest equals about thirty-three inches in the healthy adult; so high an amount as forty-three inches, and so low as twenty-eight, have been observed. The average width gradually increases from the age of sixteen to sixty: so that the mean being thirty inches from the age of sixteen to twenty, it is thirty-four from ætat. fifty-one to sixty. The capacity is, on an average greatest in robust, fat, and tall persons, and in those following trades that require active exertion of the

whole frame, but not of the upper limbs in particular (Woillez). [§ 17.]

The two sides of the chest are of unequal dimensions in about five sixths of healthy subjects; a mean excess of about half an inch existing on the right side in right-handed individuals; in left-handed persons the left side sometimes measures more, or more frequently the same as, the right.

The *morbid conditions* discovered by circular measurement are, *increase* or *diminution of bulk* of either side as compared with the other; and *defective expansion* during the act of inspiration. Deficiency of expansion, confined as it usually is to one side of the chest, is best ascertained by comparing the width of the two sides at the end of expiration and of inspiration; little or or no difference will be found to exist at the former, a very marked excess on the sound side at the latter period, under the supposed conditions of deficient expansion.

2. Circular measurement between the clavicles and nipples has as yet been so neglected, that I am not prepared to say positively whether the excess of bulk manifest in the healthy state at the lower part of the chest on the right side exists here also; I am inclined, from a limited number of observations, to believe that it does, though to a less amount than inferiorly.

The ratio existing between the measurements of the chest in its infra-clavicular and infra-mammary regions does not appear to be sufficiently constant to be trusted to in practice. The subject, however, requires further investigation. [§ 7.]

b. *Transverse.*—Respecting mensuration of the

transverse diameters of the chest, I have no precise information to offer. It should be made with a pair of callipers, and there can be little question that diagnostic data of importance might occasionally be derived from its employment. It would, however, in the greater number of cases, do little more than confirm the results of inspection; for diminution of the transverse diameter, in respect of the antero-posterior, the change which, it may be presumed, would most frequently present itself, is one of those alterations of shape which most readily attract the eye.

c. *Antero-posterior.*—A pair of steel callipers is the best instrument for determining the antero-posterior diameter of the chest. That which I have been in the habit of employing consists of two arched blades terminating at one end in a button, at the other in a straight blade of about eight inches in length, which serves for a handle; a graduated arc, fixed to one of the straight blades, passes through a hole in the other, and the graduation is so managed as to correspond to distances of inches and eighths of inches between the buttons. By applying these buttons to any two points, the distance between them is at once ascertained: the only difficulty, in comparing the diameters of the two sides of the chest, being to apply the callipers with exactly the same force, and to exactly corresponding points on both sides. [§ 18.]

In measuring the antero-posterior diameter of the summit of the chest on either side, one button of the instrument should be placed immediately under the centre of the clavicle, the other upon the corresponding point of the spine of the scapula, the

distance from both buttons to the middle line being precisely the same.

The diameter of the right side in this situation will be found, in the greater number of healthy persons, to exceed that of the left, but by so very small an amount that it need scarcely be taken into consideration where an excess at all marked is detected on that side. In other words, such an excess (for example, a sixth of an inch) on the right side, furnishes sufficient evidence of morbid depression or diminished diameter on the left; though the existence of a similar excess on the left will be still more strongly conclusive of contraction on the right.

The *morbid states* which are discovered by the measurement now described are, *diminution* (as may be inferred from what has just been said), and possibly *increase*, of the antero-posterior diameter. [§ 19.]

Increase and *diminution* may similarly be detected at the base of the thorax.

d. *Vertical.* The vertical measurement of the chest has hitherto been only practised in front; measured with the tape already described, the distance between the centre of the clavicle and the most dependant point of the corresponding ribs is found to be the same on both sides.

This distance is liable to be *diminished* or *increased* in certain states of disease.

B. Partial Measurements. — a. *Horizontal.* 1. *From Nipple to middle Line of the Sternum.* The position of the nipples in respect of the middle line is perfectly symmetrical in health; in other words, the space between that line and either nipple is exactly the same. This distance is liable

to *increase*, and more frequently to *diminution*. I have never, except in a single instance of cancerous accumulation, observed any very notable increase in this measurement; but have frequently detected diminution in cases of retraction after pleurisy, varying in amount from a quarter of an inch to an inch and a quarter.

b. *Vertical.—From Nipple to Middle Point of Clavicle or Sterno-Clavicular Articulation.* In chests of perfectly regular form the distance between these two points is precisely the same on both sides. Among the non-pathological deviations of form occurring in this cavity ranks, however, lowered position of the left nipple (*vide* § 8.); and consequently, the space comprised between the nipple and clavicle on that side may be greater than on the other, independently of the influence of disease.

The only *morbid variation* observed in this measurement is *increase*, and it is obvious from what has just been said that this sign will have more value on the right than the left side. And mensuration is less useful in respect of this sign than inspection, for, on account of the flattening of the surface, which commonly coexists with lowered position of the nipple from disease, the superficial measurement undergoes a diminution which may more than compensate for the increase produced by the latter cause. [§ 20.]

3, 4. The distances comprised between the *nipple and the antero-superior spine of the ileum*, and between the *most dependant point of the twelfth rib and the same process*, are precisely equal on the two sides in health. They undergo *diminution* on

either side in certain cases of thoracic disease; and, though I have not observed this, probably *increase* in others.

SECT. IV.—PERCUSSION.

THE act of striking the external surface of the chest for purposes of diagnosis is called *percussion;* and the immediate object of the process is the determination of the density of subjacent parts. Applied to the thorax, it serves to establish, by inference, any increase or diminution of the quantity of air naturally contained within that cavity.

The amount of density is inferred from, *a.* The nature of the *sound* elicited by percussion; *b.* The *degree of resistance*, in other words, the elasticity, of the body percussed. [§ 21.]

a. *Sound.*—The properties of the sound produced, which vary with the density of the part furnishing it, and consequently possess practical importance, are:—

1. *Its degree of "clearness."*
2. *Its duration.*
3. *Its special character.*

1. *Clearness.*—The conditions of sound commonly described as *clearness*, and its converse, *dulness*, are scarcely capable of being described: they are readily illustrated by percussing the antero-superior part of the chest and the thigh; and the sounds elicited in these two situations, the former *clear*, the latter *dull*, may be used as terms of comparison for the greater number of sounds producible in various parts of the chest. It has not been determined upon what physical properties of sound depend the conditions

called dulness and clearness; but, what is more practically important, the anatomical conditions rendering the sound clear or dull have been ascertained with much precision. *Cæteris paribus*, the denser the structure over which percussion is practised, the duller will be the sound, and *vice versa*. [§ 22.]

2. *Duration.*—The duration of the sound varies very distinctly in different parts of the chest, for instance, at the upper part of the sternum and over the heart. The greater the dulness, the shorter is the duration of the sound; but as changes in the former are much more readily appreciated than in the latter property, it is not one from which much information is derived in practice. [§ 23.]

3. *Special Character.*— The special character — that property which essentially distinguishes each variety of sound from all others — of the sound emitted by the chest in health is not easily described; the usual statement, that it is a "good clear" sound, manifestly gives no distinct notion of its nature. It conveys the ideas of softness and of hollowness to a moderate degree; but is in fact *sui generis*, and a few trials upon a healthy chest will make the student more familiar with it than could the most laboured description. The healthy special character is sufficiently marked and peculiar, to render the variations to which it is subject in disease easily perceived.

b. *Degree of Resistance.*— When percussing the chest of a subject free from all disease of that cavity, the observer is conscious of a slight yielding motion on the part of the walls, accompanied with a sensation of elasticity. It is impossible to fix the

degree of this elasticity, but the reality of its existence may at once be ascertained by percussing comparatively the anterior part of the thorax and the thigh; in the latter situation a sensation of dead unyielding resistance is experienced. [§ 21.]

Considered in respect of the manner of performing it, percussion is either *immediate* or *mediate*.

Immediate percussion, the invention of Avenbrugger, is performed by striking the surface of the chest with the points of the four fingers of the right hand united into a point on a level with each other, the ball of the thumb being placed firmly against the index finger opposite the articulation of the second with the third phalanx, so as to support and give firmness to the fingers. The hand being thus prepared, the points of the fingers are brought perpendicularly down upon the surface with a sharp and quick stroke, which is found to produce a sound varying in properties with the condition of the subjacent parts. Avenbrugger recommended, as an important precaution, that the patient's chest should be covered with a thin dress, or that the observer should wear a glove,—the object being, by either plan, to prevent the sort of clack resulting from the contact of the naked hand and skin. If, in accordance with the advice of Laennec, the hand be kept naked and the chest covered, it is very necessary, as pointed out by Avenbrugger and others, that the shirt or other covering be drawn tight over the part percussed.

Immediate percussion may be performed, as it still is by some persons, by striking the chest with the palmar surface of the fingers. [§ 24.]

This method of percussing has, however, almost completely fallen into disuse, less in consequence of the positive objections to its employment [§ 25.], than of the discovery, in mediate percussion, of a plan much more ready in its application and satisfactory in its results.

Mediate Percussion.—The distinctive character of mediate percussion, for the invention of which we are indebted to Professor Piorry, is that some solid body, interposed between the chest and percussing fingers, receives the *direct* impulse of these. In mediate percussion (or, as I shall in future call it, simply, percussion) there are two chief things to be considered—the material interposed, and the agent used for striking it.

The material interposed, termed a pleximeter (πλῆξις, percussion, and *μέτρον*, a measure), may be of different kinds. That employed by Piorry is a thin, circular, or oval plate of ivory, about an inch and a half in diameter, and provided with two prominences or handles, at nearly opposite points of its circumference, which enable the observer to hold it steadily, and apply it evenly and firmly to the surface. Innumerable have been the modifications of this, and the varieties of new pleximeters, proposed from time to time; of these the left index finger (Skerrett?), and a flat piece of india-rubber (Louis), are in my mind decidedly the best. [§ 26.]

Whatever pleximeter be employed, it should be placed in accurate and firm contact with the surface; for these reasons it has always appeared to me advisable to apply the palmar, and not the dorsal,

surface of the finger to the chest, when this is the pleximeter used. [§ 27.]

The finger may be applied parallel to the ribs, or at right angles with them. The former way of placing it is infinitely the more common; and, as a general rule, is by far the more correct, for by it only can the finger be fitted, in thin persons especially, to the irregularities of the surface. But it is sometimes both convenient and advantageous to vary the direction of the finger. [§ 28.]

Useful information may sometimes be obtained by using the four fingers of the left hand, laid firmly and closely on the surface, as a pleximeter. When the anatomical cause of variation of sound is considerable in extent, but slight in degree, there is an obvious advantage in including a space of some size under the pleximeter.

Whatever be the pleximeter used, the fingers are commonly employed as the percussing agent. Generally speaking, the index and median fingers, having their points placed upon exactly the same level, and supported by the thumb with its ball laid firmly upon the outer surface of the former, opposite the articulation of its second and third phalanges, make the best instrument for striking with. But the index finger alone may be used, especially when gentle percussion only is required, and, generally, therefore in the case of children. Under some circumstances three fingers form a useful modification; or the knuckle of the index finger (joint of first and second phalanges) may be used with good effect; in percussing the larynx, the most convenient plan is to fillip with the median finger.

When the four fingers of the left hand are used as the pleximeter, those of the right form the best agent for percussing with,—the palmar surface of the latter striking the dorsal of the former.

In the case last referred to, the percussing fingers are made to fall horizontally (the more accurately so the better) upon the surface struck; under all other circumstances, it is of essential importance that the points of the fingers fall perpendicularly upon the pleximeter. The least variation in this respect is liable to be attended with a difference in the sound elicited.

In the act of percussing, *the movement should spring from the wrist only*, the fore-arm and arm being held perfectly motionless. [§ 29.]

The force used in striking should never be great, absolutely speaking; but it may be made to vary from the most gentle tap to a smart blow, according to the object in view. Generally speaking, gentle percussion is advisable, when we desire to ascertain the amount of density of superficial parts; forcible, when deep-seated tissues are the subject of investigation. Corresponding regions of the chest, which yield sounds of the same clearness and duration when gently struck, may yield sounds materially differing in these respects if forcibly percussed, and *vice versâ;* it is therefore obvious, that both modes should be employed in every instance where accuracy of diagnosis is aimed at.

The blow should be *quickly* and *lightly* given, the fingers being withdrawn, or at least all pressure removed, the moment their impulse has been effectually communicated to the surface struck. To this

precept there is but one exception: in eliciting a particular modification of special character of the sound (*cracked-metal character*), the successful production of which depends materially on the manner of striking, it is advisable to give a slow and heavy blow, and allow the fingers to press forcibly on the part for some moments after it has been given.

The position of a patient undergoing percussion should, unless circumstances prevent it, be the sitting or the standing. [§ 30.] Where muscle of any thickness covers the part examined, it should be in a relaxed state, so as to facilitate as far as possible the close approximation of the pleximeter to the proper wall of the chest. [§ 31.] While the anterior regions are under examination, the patient must hold his head erect and allow his arms to hang loosely by his sides; his hands may be clasped across the head, to facilitate percussion of the lateral regions; and he should cross his arms pretty tightly in front, and bend his head slightly forwards, while the back is examined.

It is scarcely necessary to insist upon the importance of observing precisely the same conditions, when percussing the two sides of the chest comparatively.

Results of Percussion in the Natural State.—It is difficult, as has been said, to make intelligible by words the special character of the sound elicited from a healthy thorax; experience only can teach it. The duration and the clearness of the sound bear a definite relation to each other; whenever the former is considerable, the latter is proportionally marked, and *vice versâ*. And again, the clearness

of the sound and the sense of resistance experienced by the fingers have a manifest connection: as the former increases, the latter decreases; with the increase of the latter, the former decreases. Thus the sound is clearer in the infra-clavicular region than in the scapular; and so the sense of resistance is much less under the clavicle than over the scapula. [§ 32.]

The clearness of the sound, and, with this, as just explained, its duration, together with the amount of resistance felt, varies in different parts of the healthy chest.

a. *Anterior Regions.*—Taking the sound of the infra-clavicular regions, which is clear and of proportional duration, as the standard, scarcely any perceptible change is perceived in examining from above downwards, till the lower part of the mammary region is reached. The change becomes still more decided in the infra-mammary regions; on the right, the sound grows considerably duller, and the resistance increases, from the presence of the liver; on the left, decrease of clearness and shortened duration are distinctly detected at the internal part of the mammary region, owing to the heart. In the internal part of the left infra-mammary region, the sound may be dull, but is more commonly clear; its special character being at the same time slightly, sometimes intensely, tympanitic, in consequence of an inflated state of the stomach. The external division of the same region, on the contrary, sometimes yields a dull sound, in consequence of the presence of the spleen. The clavicular region at the sternal extremity of the bone gives a clearer

sound even than the infra-clavicular; but about the centre of the bone it becomes slightly duller, towards its humeral end considerably so. The sound obtained from the post-clavicular space is duller than that of the infra-clavicular region; even in thin persons this difference is very perceptible, though in them much less so than in fat subjects. [§ 33.] In the upper sternal region the sound is as closely as possible the same as at the adjoining end of the clavicle. No change of consequence can be detected, until we come to the inferior part of the lower sternal region; here the sound is usually dull, and may be extremely so, or, on the contrary, clear, and its special character tympanitic. The first and usual condition arises from the interference of the liver and heart; the second from distension of the stomach with food; the third from distension of the same viscus with gas.

b. *Posterior Regions.*—The sound yielded by the upper scapular region is dull; that of the lower scapular somewhat less so: a clearer sound is obtained from percussing the spine, than either of the fossæ, of the bone. The space between the edge of the scapula and spinous processes of the vertebræ gives a sound of tolerable clearness and proportionate duration; less clear, however, than the superior division of the infra-scapular: in the inferior division of this region on the right side, the sound is dull from the presence of the liver; on the left, frequently rendered clear, and of tympanitic character, by the subjacent stomach and intestines,—less frequently deadened by the influence of the spleen.

c. *Lateral Regions.*—In the axillary, the sound

equals in clearness that of the infra-clavicular region; in passing downwards, a decrease becomes evident on the right side at the upper part of the infra-axillary region; in its inferior part this amounts to marked dulness, from the influence of the liver; this region on the left side gives a clear sound of tympanitic character, for the reasons already explained in connection with this state of sonorousness.

The properties of the sound elicited by gentle and by forcible percussion differ in certain regions of the chest. Wherever an organ of greater density than the lung lies at some depth from the surface, the intervening space being occupied by pulmonary tissue, the sound will be rendered duller by striking heavily, its duration diminished, and the sense of resistance increased. By employing force, the impulse is made to reach the deep-seated organ, and the modifications referred to are the natural result. For this reason a decrease in clearness may be sooner detected by strong than by gentle percussion, in passing from above downwards in the right lateral region; the influence of the liver is thus brought into play at a higher point of the chest. On the same principle the precise extent of the heart overlapped by the lung may be defined by alternately using some force, and by merely tapping the surface.

Larynx. — The sound elicited from this organ (which is best obtained by filliping one of the fingers of the left hand applied firmly to the surface, the patient's head being thrown back, and the tissues of the neck thus brought into a state of tension) is very clear, of considerable duration, and has a distinct hollowness in its special character. The resistance

is greater under the fingers, in proportion to the clearness of the sound, than it would be in the chest.

Variations compatible with Health.

The sound yielded by the chest of different individuals varies in clearness; being, generally speaking, clear in proportion to the thinness of the walls. In accordance with this it becomes distinctly clearer [§ 34.] in subjects who, from a previous state of fatness, fall into one of emaciation. The sound is clear in children. [§ 35.] These differences are much less marked when mediate, than when immediate percussion is employed.

In some subjects the sound is unusually clear or dull, without its being possible to assign any satisfactory cause for the peculiarity. [§ 36.] In all these cases the duration of the sound varies with its clearness in the manner already described.

The acts of inspiration and expiration modify the results of percussion in two different manners; 1. By altering the volume of the lungs; 2. By altering their density.

1. At the close of an ordinary expiration the lungs may be considered to extend on the right side as far down as the sixth rib in front, and the eighth laterally. On the left side they reach to the seventh rib or thereabouts in front (except within two or three inches of the sternum, where they scarcely extend lower than the sixth, the heart lying in contact with the thoracic walls in that situation), and as far as the eighth rib laterally. On both sides of the chest they extend somewhat further down posteriorly than elsewhere. [§ 37.]

During full inspiration the lungs extend downwards in all directions somewhat further than the limits just mentioned; probably their inferior edge is then an intercostal space and a half lower than after ordinary expiration, and proportionally still lower when the lungs have been forcibly emptied of their air. At the same time the space on the left of the sternum, where, after expiration, the heart is in contact with the walls, becomes filled with lung.

It is obvious, from these facts, that the *superficial extent* of surface, from which the pulmonary sound of percussion may be elicited, will vary with the precise amount of the respiratory act at which the observation is made.

2. The density of the pulmonary tissue being in the inverse ratio of the air it contains, it is plain that the percussion sound must be rendered duller in any given point of the chest by a full expiration. In other words, the sound yielded will vary in clearness according as percussion is performed at the close of inspiration or of expiration. [§ 38.] The duration of the sound, and the sensation of elasticity perceived, follow, in the ordinary way, the modifications of clearness.

In consequence of this double influence of the respiratory movements on the sound of percussion, it is advisable, under all circumstances, and absolutely necessary in delicate cases, that the act of respiration be at the same stage of progress, when the two sides of the chest are percussed comparatively. The end of a full inspiration is in such instances the fittest moment for striking; as, by desiring the patient to hold his breath, we may be

certain of having both lungs in the same state for a short while.

In the state of health the position of the patient (except in so far as it may interfere with the act of striking on the part of the physician, or alter the tension of the patient's own muscles, or the relative position of the subcutaneous tissues,) does not affect the results of percussion. In other words, change of posture has no notable influence in modifying the relationship of the lungs and their containing walls. [§ 39.]

Morbid States discovered by Percussion.

The changes detected by percussion are comparatively few in number, and simple in nature; but the indications they furnish most precise and valuable.

They may be enumerated as follow:—

1. *Diminution of clearness*, gradually passing to perfect dulness: at the same time, the *duration* of the sound *shortened*, and the *sense of resistance increased*.

2. *Increase of clearness and of duration*, with *decrease of resistance*.

3. *Increase of clearness and of duration*, with *increase of resistance*.

4. *Alterations of special character*.

As far as it can be rendered intelligible by words, the nature of the three first of these classes of alteration is explained by their names, considered in connection with what has been already said on the subject; the case is different with the fourth class, and I shall therefore describe more particularly

Alterations of Special Character of the Percussion Sound.

Instead of the character *sui generis* which distinguishes the natural sound emitted by the chest, one assimilable to that of several well-known tones exists in certain states of disease. These special characters may be called the 1. *Wooden*; 2. *Tympanitic*; 3. *Tubular*; 4. *Amphoric*; 5. *Cracked-metal*. Absurd as some of these terms may appear, they have nevertheless the strong recommendation of being immediately suggested by the conditions of sound they refer to.

1. *The wooden character* is very closely that of the sound yielded by mediate percussion of a common table, and distinctly conveys the idea of hardness. The duration of the sound having this character is commonly less than in the natural state, and the sense of resistance experienced by the fingers is unusually great. [§ 40.]

2. The *tympanitic* character, as its name signifies, resembles that of the sounds of a drum. The note is, generally speaking, very clear; the duration considerable; the resistance of the walls slight.

3. The *tubular* character is that of the sound emitted by the trachea under mediate percussion. The note it accompanies is of some duration, the resistance somewhat greater than in the natural state. [§ 41.]

4. The *amphoric* character exists in greatest perfection in the sound produced by filliping the cheek, when the mouth is closed and fully inflated. [§ 42.]

5. The *cracked-metal* character is, perhaps, most

closely imitated by the sound resulting from striking the back of the hands, loosely folded across each other, against the knee, the contained air being forced out quickly and abundantly between the fingers at each blow. When this character modifies the percussion sound of the chest, there is coupled with it almost invariably a good deal of the amphoric note, and the combination gives a result altogether *sui generis*, which, once heard, cannot easily be forgotten. [§ 43.]

Moveableness of Limits of Dull Sound.

In cases of diminished clearness of sound, the limits within which the alteration is detected may either be *fixed* or *changeable* with the position of the patient. The former is infinitely the more common case; no matter how the posture be changed, the line of demarcation of the naturally and morbidly sounding parts commonly remains unaffected. But under certain comparatively rare circumstances, the boundaries of the dull sound may be more or less completely altered by causing the patient to vary his posture; the infra-scapular region, which may have sounded dull when he lay on his back or side, will give a clear sound after he has remained leaning forward for a short while, and *vice versâ* This moveableness of the sign indicates moveableness of its cause; and, as might be expected, fluid collection in the pleura, especially if associated with air, is the only anatomical state of which the percussion signs are ever thus characterised; the fluid will, of course, gravitate to whatever part of

the patient's chest his changes of position render the most dependent. [§ 44.]

Signs derived from the Influence of Inspiration and Expiration on the Sound of Percussion.—Dynamic Signs. [§ 45.]

Inspiration.—In health, as has been said, full inspiration increases the clearness of the sound of percussion, and equally so on both sides of the chest. Certain states of disease, impeding full pulmonary expansion on either side, interfere on that side with the production of the increased clearness discoverable on the other after full inspiration;—hence a sign founded on *comparatively deficient increase of clearness at the close of a full inspiration* on either side, the sound being equally clear on both in the ordinary state of respiration.

Expiration.—The sound of the healthy chest, we have seen, is somewhat deadened by full expiration, equally so on both sides of the chest. Certain states of the lung remove this equality by rendering the sound disproportionately dull in the situation where they exist; hence the sign of *comparatively great diminution of clearness at the close of full expiration.*

Or, on the other hand, other states of the lung, by impeding the expulsion of air from the vesicles, render the sound disproportionately clear; hence the sign of *comparatively deficient diminution of clearness at the close of full expiration.*

The limits of clear pulmonary sound are reduced in health, as we have seen, by expiration, and to the same amount on both sides. When the expulsion

of air is materially obstructed on either side, the volume of the lung is much less diminished than usual; hence the sign of *absence of change in the limits of pulmonary sound at the close of full expiration.*

Whatever be the nature of the morbid conditions of the sound discovered in any case, the space in which they exist may be either accurately defined or not; in other words, the morbid state, whatever it is, may either gradually pass into the healthy, or cease abruptly. In the latter case there is no difficulty experienced in ascertaining its precise limits; in the former, there often may be some indecision on the point, and it will be found useful to glide the pleximeter *rapidly* over the entire region under examination, continuing the percussion all the time it is moved. In this way the exact line at which dulness or other change begins may be detected in very difficult cases.

SECT. V. — AUSCULTATION.

AUSCULTATION means the act of listening, and is termed pulmonary, cardiac, &c., according as the sounds listened to are produced in the lungs, or in the heart, &c.

The direct object of pulmonary auscultation is the appreciation of certain sounds audible on the external surface of the chest, and either produced by the play of the lungs themselves, or transmitted by these organs from others in which they are actually evolved. [§ 46.]

The method of performing auscultation requires some consideration. In this point of view, the

process may be *immediate* or *mediate:* in the first case the ear is applied directly to the chest; in the second, a hollow cylinder of wood, to which the name of stethoscope was given by Laennec, is used as a conducting medium between the surface examined and the ear.

Both of these methods of auscultation have had their favourers and their detractors. The principal arguments for and against each are as follow.

The advocates of mediate auscultation urge that —1. The stethoscope can be closely applied to several points of the chest (axillary, acromial, interscapular regions, and claviculo-humeral angle, &c.), where the ear cannot be placed in accurate contact with the surface. 2. The use of the stethoscope enables the observer to auscult in a posture more easy to himself—a point of much importance for securing correct results—than that he is obliged to assume if he apply the ear directly. 3. It is indelicate to place the head upon the persons of females. 4. It is disgusting to bring the head in contact with the filthy bodies and clothes of some of the lower orders. 5. The limits within which the various sounds are perceived are more nicely circumscribed with the stethoscope than the unassisted ear. 6. Certain phenomena, as pectoriloquy, are more distinct when the stethoscope is employed. Other alleged advantages of less importance have been indicated by Laennec and his followers; these it is unnecessary to enumerate.

The partisans of immediate auscultation admit that in lean subjects it is difficult to place the ear appropriately in some few situations, but affirm that

such cases very rarely occur, and that in all others the stethoscope is an *inutile lignum*, — the direct application of the ear giving as precise indications as the employment of that instrument, with less appearance of fuss and less real trouble.

My own experience upon this question would lead to the following conclusions: — 1. That Laennec and others have greatly exaggerated the superiority of mediate over immediate auscultation in respect of the distinctness with which the phenomena are heard, and the precision with which they are circumscribed, in cases where *both* modes of auscultation *can* be employed. 2. That this distinctness and this precision are in fact greater in such cases with mediate or with immediate auscultation, according as the observer is more habituated to one or other of these modes of examination. [§ 47.] 3. That because there are cases in which the ear cannot be directly applied, or in which it is disgusting or indelicate to do so (as stated above), mediate auscultation is the method with which the student should most closely familiarise himself. 4. Nevertheless that, as it is often difficult to persuade children to allow the stethoscope to be applied, and as we may often desire to auscult an adult subject when no instrument is within reach, the ear should be practised in immediate auscultation also.

In performing auscultation several precautions, affecting the observer and the observed, are to be attended to. 1. The chest should be uncovered, or, if such exposure be inadmissible, as thin a layer of clothes as possible allowed to remain between its surface and the stethoscope. 2. All friction be-

tween the stethoscope and the patient's or the observer's clothes should be carefully prevented. 3. The position of the patient should be regulated in the same manner as for the performance of inspection; an unconstrained state of the muscles being particularly necessary, in order to ensure free entry of air into the lungs. The sitting posture is, every thing considered, the most conducive to perfect investigation, provided the chair employed have a tolerably high seat. [§ 48.] While the front of the chest is submitted to examination, the patient should sit not exactly erect, but with the trunk sloping a little backwards, the arms being allowed to hang loosely at the sides. When the observer proceeds to examine the lateral regions, the patient may be directed to clasp his hands on the top of the head, in other respects, retaining his former posture; and lastly, when the posterior regions are examined, sit upon the chair astraddle, with his back to the observer, his arms crossed, and his head bent somewhat forwards. *Mutatis mutandis*, the same precautions are to be taken when the patient stands, lies, or sits up in bed. 4. It is of importance to apply the stethoscope firmly but not forcibly to the surface: too slight or too strong pressure interferes with the accurate transmission, or alters the character, of the sounds. [§ 49.] Besides, persons with tender skins, or in a state of extreme emaciation, cannot endure rough application of the instrument. 5. Great care must be taken to ensure accuracy of contact between the skin and every point of the circumference of the end of the stethoscope; as a necessary condition for this, the instrument must be held

perpendicularly to the surface. 6. The position of the observer should be free from all constraint; he should apply his ear to the stethoscope in the same manner as the instrument to the chest; concentrate his attention upon the sound examined; and, unless a most experienced auscultator, 'proceed (as far as is compatible with the patient's safety) slowly with his examination.'—The motto *festina lente* is a good one for the beginner in the study of physical diagnosis. 7. It is advisable to commence the auscultation of patients, while they breathe in the manner to which they are naturally inclined; because it is important to ascertain the precise natural condition of the respiration, and besides, directions for the regulation of the act often puzzle. Some individuals, however, absolutely require guidance, as the moment they perceive the instrument applied to their chest, they throw the muscles of the trunk into violent and unnatural motions which of course materially impede the entry of air into the lungs. The readiest way of making such persons breathe in an efficient manner is, to perform several quick *noiseless* respirations before them, and desire them to imitate these. This method will, however, occasionally fail; our object may then be gained by desiring them to sigh, to speak, or to cough. The deep inspiration required for the performance of these acts will at once enable the observer to ascertain the condition of the murmurs; and indeed there are many states of the lung in which, quite irrespectively of the patient's manner of breathing, much information may be gained by a single cough. 8. Certain sounds produced in the pharynx are

liable to be confounded with the true pulmonary sounds of respiration; the error may be avoided by directing the patient to open the mouth, if it have been previously shut, and *vice versâ.* If the sounds heard have their seat in the lungs, they will suffer no change from this opening or closing of the mouth; if in the pharynx, they will be more or less modified in character. [§ 50.] 9. Both sides of the chest must be submitted to precisely the same examination, — conducted precisely in the same way, — as already explained in reference to Percussion. 10. Auscultation should never be considered complete, until the entire chest has been examined; it is often in some or other situation, where the symptoms would least have taught us to look for disease, that auscultation proves its existence. 11. In acute affections, auscultation should be repeated twice, at least, in the twenty-four hours.

The sounds discoverable by auscultation are of the following kinds. [§ 46.]

A. 1. The natural *respiratory* murmurs; 2. Certain modified conditions of these; 3. Sounds termed *rhonchi,* which occasionally supersede them; 4. Phenomena altogether adventitious (being produced in a situation where sound is not evolved at all in the natural state of things), but still depending upon the act of respiration.

B. The resonance of the *voice.*

C. The resonance of the *cough.*

D. Phenomena common to the sounds of respiration, of the voice, and of the cough.

E. The sounds of the *heart* and *vascular mur-*

murs, as transmitted through the tissue of the lungs.

A. 1. *The natural respiratory Murmurs.*—Two sounds, audible by immediate or mediate auscultation, attend each act of healthy respiration; one, corresponding to the movement of inspiration, the other, to that of expiration. These are the *inspiratory* and *expiratory* [§ 51.] *murmurs* or *sounds.*

The *essential or primary properties* of these murmurs, practically considered,—those which, in their modified states especially, possess diagnostic importance,—are their: 1. *Special Character*; 2. *Intensity*; 3. *Duration*; 4. *Liquidness*; 5. *Softness*; 6. *Rhythm.* [§ 52.]

By the *special character* of a sound is understood that essential peculiarity which must, under all circumstances of intensity, duration, rhythm, &c., distinguish it from others; the special character of the sounds of a piano-forte, for example, will invariably differ from that of the tones of a violin. Here also may be included that property of sound known as its "*quality.*" [§ 53.] The terms *intensity* and *duration* explain themselves. The notions of *dryness* and *liquidness* of sound may be at once obtained by squeezing close to the ear first a perfectly dry, and then a moistened sponge. Similarly, if we press together a mass of wool held beside the ear, the property of *softness* in sound will at once become intelligible; its converse, *hardness*, by grating together any two hard bodies. The *rhythm* of a sound means its mode of progression or evolution, which may be continuous and equable, or interrupted and jerking. [§ 54.]

Every sound detected by auscultation requires to be analysed in respect of these various properties. [§ 55.]

The nature and properties of the murmurs differ in the various divisions of the respiratory organs; for each of these divisions there is a healthy type of respiration, commonly termed, a. *pulmonary* or *vesicular*; b. *bronchial*; c. *tracheal*; d. *laryngeal*; e. *pharyngeal*; according to the part of the respiratory system from which the sounds audible externally are transmitted.

The sole point in which these varieties of respiration agree is, that in all of them the audible sound may be resolved into two—an inspiratory and an expiratory. From their numerous distinctions they require separate consideration.

a. *Pulmonary or vesicular respiration.* [§ 56.]

The *inspiratory* murmur is a sound of gentle breezy character [§ 57.], neither liquid nor dry; soft, of a certain intensity and duration [§ 58.], and in respect of rhythm, gradually developed and continuous.

The *expiratory* murmur [§ 59.] possesses identically the same properties as the inspiratory, except in respect of intensity and duration. It is about three or four times less intense and shorter than the latter sound. [§ 60.]

These two murmurs so closely follow each other in each healthy respiration, that they may, practically speaking, be said to be continuous. [§ 61.]

Variations compatible with Health.

The precise condition of the respiratory murmurs may differ within certain limits, and in certain modes,

from that just described, without the type of respiration ceasing to be healthy. In other words, there are *healthy varieties* of respiration. They are referrible to the following circumstances: *age; the part of the chest examined; the rapidity and fulness of respiration; temperament and idiosyncrasy.*

Age. The description given of healthy respiration refers to that of adults; at either extremes of life its characters are different. In infancy the *intensity* of the sounds is considerably greater than at a more advanced age, all the other properties of both sounds remaining unaltered both positively and relatively (*puerile* respiration). [§ 62. 68.] In old age, on the other hand, the *intensity* of the sounds is much diminished, and the duration of inspiration lessened, while that of expiration is increased (*senile* respiration). [§ 63.]

Part of the Chest examined. The *intensity* of the respiratory murmurs has been stated to attain its maximum in the axillary and post-clavicular regions; and in general terms is said to be greater than elsewhere where the lung is brought during dilatation most closely to the wall of the chest. (Laennec.) [§ 64.]

Between the scapulæ, over the upper part of the sternum [§ 65.], and occasionally in the axilla, the respiration presents more or less distinctly a *bronchial* character. [§ 65.]

The characters of the respiratory murmurs do not differ in the corresponding points of the two sides of the chest to any appreciable amount. [§ 66.]

There is no excess, as a natural condition, in the duration and intensity of the expiratory murmur in

any one part of the chest compared with others. [§ 67.]

Rapidity and fulness of Respiration. The *intensity* of the respiratory murmurs increases directly as the rapidity of respiration; their *duration*, as its fulness. When the respiration is at once full and rapid, both properties of the murmurs are affected simultaneously. [§ 68.]

Temperament. The respiratory murmurs are generally speaking of greater intensity in subjects of nervous temperament, or labouring under certain nervous affections, as hysteria, and in those whose chests are of large capacity and provided with thin walls, than in persons otherwise constituted.

Idiosyncrasy. In some subjects the respiratory murmur is unusually weak or unusually strong, without its being possible to trace the peculiarity to any particular cause; it is then spoken of as an idiosyncrasy.

The proportional duration and intensity of the expiratory sound vary much in different subjects; in not a few persons expiration is completely unattended with audible sound. This absence of expiratory murmur is, according to my experience, most frequent in males. [§ 59.]

b. *Bronchial respiration* is characterised by a deficiency in both murmurs of the perfect softness and gentle breeziness belonging to the pulmonary species; the sounds are slightly harsher (less so, however, than in morbid bronchial respiration) [§ 69.], more rapidly evolved, especially the expiratory; and follow each other less closely than in pulmonary respiration. [§ 61.] The situations in

which this modification of the murmurs is observed have just been stated. [§ 65.]

e. d. e. *Tracheal, laryngeal, pharyngeal* respiration. The respiratory sounds, as heard over the trachea, larynx, and pharynx, are considerably more intense, less soft, drier, somewhat whiffing, and more rapidly evolved, though of greater duration, than in the divisions hitherto considered. While in pulmonary respiration the two sounds differ very materially in duration and intensity, in these upper sections of the system they tend to equalisation in this respect; and instead of being almost continuous, are separated by an interval of some duration. [§ 61.] Laryngeal respiration is attended with a cavernous character, in addition to the peculiarities just mentioned.

Such are the *natural* or *healthy* murmurs in the different sections of the respiratory organs; they have now to be considered in their *unnatural* or *unhealthy* states.

A. 2. *Modified Conditions of the Respiratory Murmurs.*

Pulmonary or Vesicular.—It is extremely rare to find one only of the primary properties of the respiratory sounds affected; in by far the greater number of cases two or more of them suffer alteration at the same time; and thus are produced compound conditions of change, which may be described as distinct species. These species of unhealthy respiration may be classified as follow. [§ 55. 70.]

Species of unhealthy Respiration, distinguished by Changes of

α. *Duration and Intensity.*	a. Exaggerated respiration.	
	b. Weak ...	
	c. Suppressed ...	
β. *Rhythm*, either solely or in conjunction with other properties.	d. Incomplete respiration.	
	e. Jerking ...	
	f. Divided ...	
γ. *Character*, and in addition other properties.	g. Harsh respiration.	
	h. Bronchial ...	
	i. Blowing ...	1. Diffused.
		2. Tubular.
		3. Cavernous.
		4. Amphoric.

α. *Changes of Duration and Intensity* — a. *Exaggerated respiration* [§ 71.] is essentially distinguished by an increase in the intensity and duration of both murmurs, *especially the expiratory*, — an increase unattended with modification of any kind, either in respect of special character, softness, or liquidness. [§ 72.]

b. *Weak respiration* is characterised by a simple diminution in the *intensity* and *duration* of the respiratory sounds, without change of their other properties. When, as is sometimes the case, the *special character* of the expiration is simultaneously altered, the respiration belongs to another type. There are two varieties of weak respiration ; the *superficial*, and the *deep-seated.* In the former the weak murmur appears to be produced on the surface of the lung or immediately under the walls of the chest ; in the latter, at a greater or less distance from these walls. The *superficial* variety may be either *persistent* or *intermittent.*

c. *Suppressed respiration* consists in a total absence of the respiratory murmurs, without their being replaced by any kind of audible phenomenon. There is a complete negation of sound in the part. [§ 73.]

β. Changes of Rhythm.—d. *Incomplete Respiration.* Instead of the murmur of inspiration being equably continuous to the close of the *movement* of inspiration (or coeval with this), it is in some cases deficient at its *commencement* or *close.* These changes appear to me most strictly referrible to the present class.

In the former case no audible sound is produced during the earliest part of the movement of inspiration, but towards the end (when the chest is most expanded) a slight murmur is heard. In the latter case the inspiratory sound commences with the movement of inspiration, but is brought to an abrupt close before its conclusion. [§ 74.]

e. *Jerking Respiration.* When the movement of inspiration, instead of being accompanied by a murmur continuous from the outset to the close (which may be represented thus ———), is attended with a sound of an interrupted character, divided into several unequal parts (thus —— | – | —— | ——&c.), the respiration may be called *jerking.* The expiratory sound does not possess this peculiarity, but is generally somewhat increased in duration, while the inspiratory is certainly somewhat decreased in this respect. [§ 75.] The *special character* of the *inspiration* may have a tendency to harshness, and (by an exception to the general law) more than that of the *expiration.*

Jerking respiration may exist though an entire lung, when it deserves the name of *general;* or be limited to a certain spot, when it may be called *partial.*

f. *Divided Respiration.* Instead of the two murmurs, inspiratory and expiratory, succeeding each other so closely in each act of respiration that they may be considered continuous, they are sometimes separated by a distinct interval or pause: to respiration of this rhythm the name of divided may be given.

γ. *Changes of Character, and in addition of other Properties.*—g. In *harsh respiration* both murmurs have lost their natural *softness;* a peculiar *dryness* accompanies them; the breezy character of health is exchanged for one sharper and more blowing, which is generally more marked in expiration than inspiration. The *intensity* of the expiratory murmur appears augmented from this superadded character; its *duration* is increased. [§ 76.] Both these latter properties may be, and commonly are unaffected in the inspiratory sound. This type of respiration insensibly passes into the following.

h. *Bronchial respiration* is a higher grade of the *harsh* type. Both murmurs are *rough* and *hard,* and notably more *dry* than in the natural state; the sharp blowing *character* is heard in inspiration as distinctly as in expiration [§ 77.], and in the latter to a greater degree than in respiration of the previous type; the *intensity* of both sounds appears increased, and the *duration* of expiration is very considerably augmented. [§ 69. 78.]

. In *blowing respiration* both murmurs are blow-

ing; and, in its most marked degrees, a sensation as if the air were drawn during inspiration from the observer's ear, or from the surface of the chest, and puffed back during expiration, is distinctly perceived. Both murmurs are continuous, *rougher* and *harder*, and especially *more dry* than in altered states of less advanced type, and *the metallic character* distinctly accompanies them. The expiratory sound is of much *greater duration* than in the natural state: the inspiratory varies in this respect. In both, *quickness* [§ 79.] of production and progress constitutes (in the most marked forms especially) a remarkable feature, and their *intensity* is more or less above the natural mark.

There are four varieties of *blowing respiration* [§ 80.]:—i. 1. the *diffused;* i. 2. the *tubular;* i. 3. the *cavernous;* i. 4. the *amphoric.*

i. 1. *The diffused variety.* If to the description above given be added the qualification that the puffing murmurs appear to be produced with but moderate intensity, and sometimes at a distance from the ear, over a tolerably extended space, the description of the diffused variety will be completed.

i. 2. In the *tubular variety*, on the contrary, the phenomena appear to occur in a space limited to the immediate neighbourhood of the part examined, and that space to be of tubular form. The metallic character is highly developed, to such a degree that the sounds may, without exaggeration, be compared to those produced by blowing through a brass tube: their *rapidity of production* and *intensity* is much greater than in the *diffused* variety. It is in the tubular variety, too, that the sensation of air being

drawn from and puffed back into the ear is most distinctly marked.

i. 3. In the *cavernous variety* the ear receives the impression most distinctly of air passing into and out of an excavation of moderate size and rounded shape: the *character* of the murmurs is *hollow*, blowing, and strongly metallic. The peculiar *quickness* of production is less marked than in the diffused variety, and consequently still less so than in the tubular. [§ 81.]

i. 4. *The amphoric variety.* The *special character* of this variety is derived from the sensation, which attends it, of air passing into a large empty cavity having dense walls—such as is perceived by blowing into a water-croft. It is strongly metallic, and sometimes, but rarely, *associated in one and the same respiration* with *metallic tinkling.* The amphoric character accompanies both sounds, but especially the expiratory [§ 82.]; and the general description of *blowing* respiration applies accurately in other respects to this variety. [§ 83.]

A. 3. *Sounds superseding the Respiratory Murmurs: Rhonchi.*

Besides the unnatural states of the murmurs so far described, there are other kinds of morbid sound produced in the air passages, which are capable of masking more or less completely the natural murmurs: these sounds are called *rhonchi* or *râles.*

The essential difference between the phenomena previously considered and rhonchi is that in the former a *modification* only of a natural state exists;

in the latter, a *new phenomenon* is added to those previously existing.

Definition.—A *rhonchus* is an unnatural sound audible in inspiration or in expiration, or in both; of dry or humid character; masking the natural murmurs more or less completely; persistent or interrupted; originating in the minute or the larger bronchi, in excavations of the pulmonary substance, or (probably) in the tissue of the lung itself [§ 250.]; and produced either by the passage of air along bronchi of altered caliber, by air bubbling through fluid contained in those tubes, or (probably) in certain conditions of the pulmonary substance by motions of that substance on itself. [§ 250.]

Various modes of classifying rhonchi have been proposed: the following arrangement, founded on their amount of liquidness and their special character, seems the most practically useful.

Degree of Liquidness.		Special Character.	
A. *Dry.*	a. Of *shrill tone.*	1. Sibilant.	Whistling. Clicking.
	b. Of *grave tone.*	2. Sonorous.	Snoring. Rubbing. Cooing.
	c. Of *tone rather shrill than grave.*	3. Dry crackling.	
B. *Humid.*		4. Crepitant.	a. Primitive. b. Redux.
		5. Subcrepitant	a. True subcrepitant. b. Humid ... c. Continuous ...
		6. Humid crackling.	
		7. Mucous, sub-mucous.	
		8. Cavernous, cavernulous.	
Of Doubtful Nature.		"Pulmonary crumpling sound." "Dry crepitant with large bubbles."	

A. *Dry.*—a. *Of shrill Tone.* 1. *Sibilant* rhonchus, as its name denotes, is a whistling sound, commonly coexisting both with inspiration and expiration, but especially marked in the former, with which only it may coexist [§ 84.], varying much in intensity and in duration, and recurring irregularly, instead of accompanying every respiratory movement.

Upon differences in duration mainly are founded two varieties, the short and the prolonged, or the *clicking* and the *whistling.* The former is a quick sharp sibilus, which ceases almost as soon as produced; the latter, a prolonged sibilation, of less sharpness, more slowly evolved, and sometimes lasting the entire length of the movement it accompanies.

b. *Of grave Tone.* 2. *Sonorous* rhonchus is a sound varying in special character, always marked by graveness of tone and dryness; usually coexisting both with inspiration and expiration, but especially marked in the latter, to which it may be limited; varying in intensity from a very slight sound to one loud enough to be audible at some distance from the chest, and to be attended with fremitus of the walls of the thorax over a surface of variable extent; varying in duration, but having a natural tendency to prolongation; continuously and steadily evolved unless of very short duration, when it is produced in a quick and abrupt manner; occurring interruptedly or attending every successive respiration (the latter is very rare); and sometimes alternating with the sibilant form of dry, or with mucous, rhonchus.

The special character of the sonorous rhonchus varies; hence arise a certain number of *varieties.*

In the *snoring* variety, the sound is like the harsh full noise produced by a man snoring. When the sound is of short duration, rapidly and abruptly evolved, it resembles that produced by gently but quickly rubbing the finger, slightly wetted, upon a pane of glass, and may be called the *rubbing* variety [§ 85.]: under other circumstances it resembles the musical and plaintive sound uttered by the wood-pigeon, and constitutes the *cooing* variety.

c. *Of Tone rather shrill than grave.* The *dry crackling rhonchus* [§ 86.] is composed of a succession of minute, dry, short, sharp, crackling sounds, few in number, rarely exceeding three or four in a respiration; coexisting exclusively, or almost exclusively with inspiration [§ 87.]; persistent, in the great majority of cases, after its characters have once been fully developed [§ 88.], until it ceases altogether to be produced, in consequence of its passing into the humid crackling rhonchus [§ 89.]; and usually conveying the impression to the ear of being evolved at a distance from the surface. [§ 90.]

B. *Humid.*—4. *Crepitant* rhonchus. a. *Primary.* This rhonchus, as its name indicates, suggests the idea of crepitation. [§ 91.] When most perfectly developed, it occurs in puffs more or less prolonged, but rapidly evolved [§ 92.], composed of an immense number [§ 93.] of sharp crackling sounds, all perfectly similar to each other; conveying the notion of minute size; dry [§ 94.]; coexisting exclusively, except in rare cases, with inspiration [§ 95.]; and once established, remaining a persistent condition until superseded by other phenomena. [§ 96.]

b. *Redux.* The rhonchus crepitans redux, like its predecessor, suggests the idea of crepitation; but the crepiti constituting it are of more humid character and commonly more suggestive of "bubbling;" they convey the impression of larger size; are more slowly evolved, rarely, if ever, occurring in the abrupt puffs last noticed; are comparatively few in number; are more or less dissimilar to each other; somewhat irregular in occurrence; and frequently audible in expiration as well as in inspiration, though more specially appertaining to the latter. [§ 97.]

5. *Subcrepitant Rhonchus.* Here the component crepitations have a distinctly bubbling character; they are of moderate size; humid; scarcely ever occur in puffs; are evolved with variable quickness, but rarely with much rapidity; are few in number and dissimilar to each other; occur with more or less irregularity; and attend both respiratory movements.

The different properties of this rhonchus are subject, within certain limits, to variation; hence arise varieties which are each distinctive of a separate malady, especially when the properties of the sounds are considered in connection with the seat of their production.

a. In the *true subcrepitant*, the bubbles are of the smallest size observable in any variety of this rhonchus; their humid property is masked by viscidity; there is a certain tendency to occur in puffs, which are evolved with some abruptness; the bubbles are tolerably numerous and inclining to similarity in point of size; they occur with regu-

larity, and are much more marked in inspiration than in expiration.

b. In the *liquid* variety the bubbles are larger, distinctly liquid, and non-viscous; they do not occur in puffs, are of unequal size, recur irregularly, and attend expiration almost as abundantly and constantly as inspiration.

c. *Continuous.* Here the bubbles are of large size; rather conveying the impression of viscidity than liquidness; very few in number; slowly and laboriously produced; permanent; running into each other so as to produce a single continuous sound, and coexisting exclusively with inspiration. [§ 98.]

6. *Humid Crackling.* A rhonchus composed of a series of crepitations, having a clicking character; few in number; of moderate size; occurring during both respiratory movements, but with greater regularity and distinctness of character in inspiration; and eventually passing into, or rather superseded by, the mucous species.

7. *Mucous Rhonchus.* A rhonchus composed of bubbles of some size, considerably larger than those of the subcrepitant; variable in number, and unequal in size; distinctly liquid; irregular in recurrence; modified by the acts of coughing and of expectorating, and coexisting with both respiratory movements.

Two varieties are admitted, founded upon the size of the bubbles: the *mucous* and the *submucous*. The size of the bubbles localises the rhonchus in the larger or smaller bronchi.

8. *Cavernous Rhonchus.* This rhonchus consists

of a limited number of bubbles of large size, distinctly humid, occasionally ceasing to be produced for a time [§ 99.], having a peculiarly hollow metallic character, and coexisting commonly with inspiration and expiration,—in some cases with either alone,—and with or without cavernous respiration. [§ 100. 212.]

The size of the bubbles varies; and to this circumstance is owing the establishment of two varieties,—the *cavernous* and the *cavernulous*. (Hirtz.) In the latter there is distinctly a clear metallic character, but the sensation of hollowness is not perceived, or at least imperfectly.

A species of gurgling, resembling cavernous rhonchus somewhat, may be produced in large cavities from the shaking of their contents by the impulse of the heart. [§ 173.]

Of doubtful Nature. — *Pulmonary crumpling Sound or Rhonchus* (*Bruit ou Râle de Froissement Pulmonaire*). A sound described by M. Fournet as conveying to the ear the impression of the crumpling of a tissue pressed against a hard resisting substance; commonly limited to inspiration, but sometimes attending expiration also; audible only in the immediate seat of its production, and presenting itself in the three following forms:—1. In its most intense form the sound is a new leather creak, differing from that of pericarditis simply by the greater acuteness of its *quality*: 2. In a less intense degree it consists of a plaintive noise, of varying intonation, according to the state of oppression of the patient, and the force and rapidity of respiration: 3. and in its weakest and

most common form resembles the gentle, quick, dry sound produced by blowing on fine paper.

This sound was detected by M. Fournet in the first stage of phthisis ($\frac{1}{8}$ of the cases), in one case of encephaloid tumour of the mediastinum, and in another of non-tuberculous cavity of the summit of the lung. The existence of a mechanical obstacle to the expansion of the lung, lobular induration of the pulmonary texture, and alternate flapping backwards and forwards of a fibrous lamina forming the wall of a cavern, seemed to be the physical conditions leading to its production. [§ 101.]

Dry crepitant rhonchus with large bubbles (*Laennec's Râle crepitant sec à grosses Bulles*), "observed only during inspiration, conveys the impression as of air entering and distending lungs which had been dried, and of which the cells had been very unequally dilated, and entirely resembles the sound produced by blowing into a dried bladder." Such is Laennec's description of a rhonchus which he believed pathognomic of emphysema, pulmonary and interlobular, but which his successors have failed in detecting.

A. 4. *Phenomena altogether adventitious, being produced in a Situation where Sound is not evolved at all in the natural State of Things.*

Daily experience proves that the collision of the opposite laminæ of each pleura during inspiration and expiration is not in the healthy state productive of appreciable sound. Experiments upon the lower animals might, were this necessary, be referred to in confirmation of the fact. This noiselessness of

movement of the pleural surfaces upon each other depends upon their perfect smoothness and slight humidity; when these conditions become changed by disease this gliding motion is attended by different modifications of sound, varying with the nature and amount of the existing anatomical change. These different sounds all agree in being produced by, and in conveying the sensation of friction; they are, therefore, commonly designated as *friction sounds.*

Pleural friction sound consists either of a single, or, more commonly, of a series of jerking sounds, few in number, and manifestly superficial in seat: it is audible over a variable, but usually limited extent of surface; persistent or intermittent; of variable, but commonly more or less considerable duration [§ 102.]; varying, in point of intensity, from a scarcely audible noise to one of extreme loudness; attended with a sensation of dryness [§ 103.]; almost invariably heard in inspiration, and always more intensely developed with that movement; most frequently accompanying both inspiration and expiration, rarely, if ever, expiration alone; produced with ordinary respiration, or developed only after coughing or by deep inspiration; and in strongly marked cases attended with fremitus palpable to the hand, and perceptible to the patient.

The modifications of intensity and special character of friction sound justify the establishment of four varieties: a. the *grazing*; b. *rubbing*; c. *grating*; d. *creaking.*

a. *The grazing variety,* the most delicate form of friction is usually a single sound; audible over a very limited extent of surface; occurring with an

occasional respiration only; remarkable for mobility; more rapidly evolved and of less duration than the other varieties; attended with a sensation of dryness, and limited strictly to inspiration.

b. *The rubbing variety* resembles the sound produced by firmly rubbing the fingers slightly moistened along a pane of glass; it consists of a series of jerking sounds, rarely exceeding three or four in number; is audible over a tolerable extent of surface, provided the necessary condition of motion of the lung exist [§ 102.]; of rather considerable duration; is slowly evolved, and attends both inspiration and expiration.

c. *The grating variety* conveys the sensation indicated by its name; and, except in respect of its greater intensity, is characterised as the last variety.

d. *The creaking variety* is suggestive of the noise produced by the creaking of new leather of moderate hardness; in other respects it resembles the rubbing variety, with which it has a tendency to co-exist. [§ 104.]

Modified Conditions of the Respiratory Murmurs in the Trachea and Larynx.

As far as these conditions have hitherto been detected, they are few in number, uncertain in their production, and comparatively deficient in diagnostic value; to these facts may be attributed their having been so far but imperfectly investigated. [§ 105.] Nevertheless they are useful *auxiliaries* in the diagnosis of many cases of laryngeal disease, especially when compared with the results of bronchial and pulmonary auscultation; indeed, without

this comparison, it is sometimes very difficult to affirm whether a given rhonchus is actually produced in the larynx or transmitted from the bronchi. [§ 106.]

The chief morbid phenomena occurring in the larynx are —

$$\begin{array}{l} \textit{Harsh respiration.} \\ \left.\begin{array}{l} \textit{Sibilant} \\ \textit{Sonorous} \\ \textit{Valvular} \\ \textit{Gurgling} \\ \textit{Flapping} \end{array}\right\} \textit{Rhonchi.} \end{array}$$

Harsh laryngeal respiration is distinguished by the hardness and dryness of both murmurs; their intensity is increased; their *positive* duration somewhat increased also; their *relative* duration unaffected; they have a cavernous character.

Sibilant laryngeal rhonchus existing in the larynx has precisely the same special character as in the bronchi; it is commonly, however, of greater intensity, and may be so loud as to be audible at a distance from the patient [§ 107.]; usually attends inspiration and expiration, but is always much more marked in the former, and may be absent in expiration altogether.

Sonorous laryngeal rhonchus has precisely the same properties as the bronchial rhonchus of that name; in some instances it acquires a very distinct metallic character. [§ 108.]

Valvular laryngeal rhonchus may be the name applied to a peculiar phenomenon occurring in the larynx, and described by Dr. Stokes as resembling the noise produced by the "rapid action of a small valve, combined with a deep thrumming sound."

Gurgling laryngeal rhonchus, like the pulmonary rhonchus of the same name, also called cavernous, consists of a number of bubbling sounds, produced in inspiration and in expiration, and commonly attended with a distinctly metallic character.

Flapping Laryngeal Rhonchus.—This phenomenon, detected by M. Barth, is described by him as a vibrating tremulous murmur, such as might be produced by a thin moveable membrane agitated by the air. It is more easily conceived, than explained by words.

B. *The Resonance of the Voice.*—The particular rules for performing auscultation of the voice are not very numerous. It is of great importance that its intensity and tone be precisely the same, while both sides of the chest are examined; and in order to ensure this uniformity, the observer may cause the patient to count a certain number of figures at a measured and even rate. Generally speaking, a loud tone should at the same time be directed; but in the auscultation of the voice over caverns, the most decisive information is sometimes obtained from the whisper, beyond which the patient is in the advanced stages of tuberculous disease frequently unable to raise his tone.

The stethoscope should be laid firmly upon the surface, and the ear similarly applied to the instrument, but without any degree of forcible pressure; if either be too lightly applied, a tremulous bleating character may be given to the resonance; if too forcibly, the distinctness of this is diminished. It is scarcely necessary to add, that the instrument

should be used in precisely the same manner and in precisely corresponding spots upon both sides of the thorax.

The condition known as exaggerated resonance, or diffused bronchophony (*vide* p. 71.), is perhaps more accurately appreciable by means of immediate than mediate auscultation; all other unnatural states of vocal resonance are more satisfactorily and distinctly ascertained with the stethoscope.

In examining certain regions great care must be used both in the manner of applying the instrument, and in drawing inferences from the results obtained; the chief of these regions are the post-clavicular, the upper sternal, and the interscapular. The vicinity of the trachea or large bronchi is, without such care, liable to mislead the observer, by the naturally greater resonance to which that vicinity gives rise. When the post-clavicular space is examined, especially its inner part, the stethoscope should be held as nearly as possible parallel to the trachea.

Natural Vocal Resonance.—If the stethoscope be applied over the larynx or trachea of a healthy individual while speaking, the voice is transmitted, imperfectly articulated, through the instrument to the ear, with a degree of force, loudness, and concentration so great, that the experiment may be productive of actual pain to the observer, especially if the voice examined be grave and strong. The same transmission of the voice occurs at the lateral parts of the neck (and even over the spinous processes of the vertebræ behind), but with less intensity than on the middle line in front. The re-

sonance of the voice heard in these situations is called *natural laryngophony* and *tracheophony*.

At the upper part of the sternum, on the middle line, a considerable decrease of intensity in the natural vocal resonance, as compared with that just described, is observed; towards the edges of the same part of that bone a still further diminution is perceptible, and the resonance is here reduced to that state called *natural bronchophony*. The sound is now more diffused, and the voice appears to be (as it is) produced at a greater distance, and is not transmitted through the instrument. This species of resonance is also observable posteriorly on the middle line over the division of the trachea, and on either side of that division between the spines of the scapulæ. [§ 109.]

Over the surface of the chest, with the exception of the parts just referred to, the natural resonance of the voice amounts to no more than an obscure and diffused buzzing, unattended with the least approach to articulation, and appearing to originate at a certain depth within the chest, and over a certain extent of surface.

The amount and special character of this natural resonance are modified by certain circumstances altogether independent of disease. The chief of these, and the modes of modification they produce, are as follow:—

1. The natural resonance is *cæteris paribus* marked in proportion to the graveness of the voice. This statement is only true of intensity, however; there is no greater tendency to concentration or articula-

tion of the sound when the voice is grave than when it is shrill. [§ 110.]

2. The natural resonance of the voice is, as a corollary from the last proposition, more marked in males and in adults than in females and in children. [§ 110.]

3. The special character of the resonance varies with the quality of the speaking voice; thus in subjects of advanced age it is very commonly tremulous and bleating.

4. The natural resonance is more strongly developed the larger the chest, and the less loaded its walls with fat and muscle.

5. It is stronger in front than behind (with the exception of the interscapular region), and at the upper than the lower parts of the thorax.

6. It is equal on both sides of the chest, except under the clavicles, and in the spaces between the spines of the scapulæ and median line: in these regions the phenomenon is more strongly marked on the right side. [§ 111.]

7. The intensity of vocal resonance, as of the respiratory murmurs, varies much in different subjects apparently presenting the same physical conditions for its development. Hence arises the difficulty, and commonly the impossibility, of drawing any inference directly from the state of vocal resonance in a given portion of the chest; it is only by the application of the principle of comparison of the two sides that any safe result can be obtained.

Unnatural or Morbid Vocal Resonance. — The modifications of natural resonance which arise in disease may be classed as follows: —

Vocal Resonance.

Diminished in intensity.	1. Weak resonance. 2. Suppressed resonance.
Increased in intensity.	3. Exaggerated resonance. 4. Bronchophony.
Increased in intensity and altered in special character.	5. Ægophony. 6. Pectoriloquy. 7. Amphoric resonance.

1. *Weak resonance*, as its name implies, signifies a state in which the vocal resonance is distinctly less marked than natural; it is of rare occurrence, and can only be established as a local phenomenon by comparative examination.

2. *Suppressed resonance* means that rare condition in which all transmission of the voice to the surface has ceased; no audible sound being conveyed there.

3, 4. *Exaggerated resonance* and *bronchophony* are little more than degrees of each other, both as regards their nature and their cause. The amount of resonance in the former undergoes simple increase; in the latter there is, besides, a greater concentration of sound: the former may be considered a *diffused* bronchophony; the latter a *concentrated* resonance of exaggerated force. In bronchophony the sound is also clearer, and more distinct; but still always unattended with articulation, and rarely appearing to enter the stethoscope. It is usually a persistent phenomenon, so long as it exists; that is, produced every time the patient speaks. [§ 112.] The space in which it is discoverable is frequently rather sharply defined; in other words, the transition from the most distinct bronchophony to the natural resonance is sudden:

more commonly still a gradual diminution of the phenomenon is traceable. It may be *simple*, or partake of the tremulous and bleating tone especially characterising ægophony; under the latter circumstances it may be termed *broncho-ægophony.*

5. *Ægophony* (αιγος, gen. of αιξ, *a goat*, and φωνη, *voice*) is the name given by Laennec to a peculiar modification of vocal resonance, distinguished by its tremulous, nasal, and cracked character, suggestive of the bleating of a goat. When most strongly marked it is distinctly metallic, jarring, and muffled; is synchronous with the articulation of each word, or follows it immediately, like a shrill echo of natural resonance; conveys the idea of a distant origin; does not appear to traverse the stethoscope, but rather to flutter tremulously about the applied end; is persistent, but of short duration; audible over a very limited surface, and occasionally capable of being altered in position by varying the posture of the patient. [§§ 113. 190.]

Certain varieties of ægophony, depending sometimes upon associated bronchophony, in other instances upon conditions not easily determinable, are observed with some frequency. The tones of these varieties have been happily compared by Laennec to — 1. The sound of the voice through a metallic tube or cleft reed; 2. Of the voice of a person speaking with something between his lips and teeth; 3. The nasal twang assumed in speaking by the exhibitors of Punch.

6. *Pectoriloquy* signifies a state of vocal resonance in which the voice appears to resound in a hollow space, and is transmitted as articulate words

through the stethoscope to the ear of the observer. In its most perfect state, the patient appears to speak directly into the ear; the resonance is loud, hollow, metallic, and is limited to an accurately defined space. Though usually an equable and persistent phenomenon, it is capable of being affected in amount by certain circumstances, or even of being temporarily removed altogether. [§ 114.]

Although, generally speaking, pectoriloquous resonance is loud, this property may be remarkably modified by the calibre of the patient's voice. The hollow and metallic characters, the insulation of the phenomenon, and its transmission through the stethoscope are distinctly marked, even when the voice of the subject is almost destroyed; but when the physical conditions of its production exist in a subject thus reduced almost to a state of aphonia, it assumes a low whispering tone, and may be correctly termed *whispering pectoriloquy.*

In certain cases pectoriloquy has a tremulous, and so acquires some slight degree of ægophonic, character. [§ 115.]

7. *Amphoric Resonance.*—When the vocal resonance has a metallic character, is not transmitted through the stethoscope, is not articulate, but conveys the impression of its being produced in a hollow space of large size, it is called *amphoric*, from the similarity of the phenomenon to that produced by speaking into an empty pitcher.

C. *The Resonance of the Cough* (*Tussive Resonance*).—In performing auscultation of the cough, precisely the same precautions are to be observed as in the case of the voice.

If the stethoscope be applied over the larynx or trachea of a healthy person while coughing, the act of expiration is found to be accompanied by a sound of hollow tubular character, varying in respect of graveness and intensity with the voice of the individual; the observer is not conscious of any sensation of succussion in the site of its production.

Auscultted on the surface of the chest, the cough of healthy subjects furnishes a quick, short, commonly dull and indistinct, somewhat diffused sound, without hollow or tubular character, but attended with a distinct sensation of succussion of the interior of the thorax.

The modified states of the pulmonary cough, which occur in disease, are the

Bronchial,
Cavernous,
Amphoric.

Bronchial cough, when well marked, is a sound of harsh character; is attended with a sensation of very marked succussion in the chest, and a slight degree of impulsion towards the ear of the observer; is very rapidly evolved, and more concentrated under the instrument than the natural sound.

Cavernous cough is characterised by its perfect hollowness and metallic character. The sensation of production in an excavated space of limited size, the strong impulsion and transmission of the sound through the stethoscope with a force sometimes painful to the ear, are quite distinctive of this species of resonance.

Cavernous cough may be pure, or associated with cavernous rhonchus; if fluid be present in the

cavity to a moderate amount, it will not interfere with the production of the characteristic cough, and the forcible agitation the liquid matter undergoes during cough will of course be attended with rhonchus.

Amphoric cough is a loud resounding sound of metallic character, conveying the notion of production in a large space more or less empty; it is not forcibly transmitted through the stethoscope.

D. *Phenomena common to the Sounds of Respiration, of the Voice, and of the Cough.*

These are *Metallic Tinkling* and *Metallic Echo*.

These phenomena, varieties of each other, are distinguished from all those hitherto considered by their accompanying indifferently the acts of respiration, of speaking, and of coughing.

Metallic tinkling is the name given to a quick, sharp, ringing sound, closely resembling that produced by gently striking a hollow metallic or glass vessel with a pin.

Metallic echo differs from tinkling simply in the greater prolongation and less concentration of the sound, which appears to vibrate and re-vibrate in the interior of the chest: the metallic character is, also, less purely and strongly defined.

Metallic tinkling, occurring in connection with respiration, co-exists commonly with inspiration, being prolonged somewhat into the expiration following, and is very rarely limited to the latter. [§ 116.] Generally speaking, it alternates irregularly with an amphoric state of the respiratory

murmurs, the one unnatural state giving place to the other, after a variable and for a variable number of respirations. [§ 198.] It appears to be produced deep within the chest, or near the surface; and is rarely persistent for any considerable number of respirations.

Metallic tinkling is less commonly produced with respiration than as a phenomenon of vocal or tussive resonance. In some instances it is evolved only by forcible coughing.

In certain rare cases, a sound exactly similar to or identical with metallic tinkling is perceived, independently of respiration, voice, or cough, when the patient suddenly changes from the recumbent to the sitting or erect posture. [§ 198.]

E. *Sounds of the Heart and Vascular Murmurs, as transmitted through the Substance of the Lungs.*

a. *Sounds of the Heart.*—The extent of surface over which the sounds of the heart are audible varies in healthy subjects within certain limits. Audible in the generality of persons over the entire front of the chest and on the left side posteriorly, their existence is little more than suspected on the right. Where disease of the heart exists, the limits of propagation will vary according to the nature of that disease, either in the direction of decrease or increase. But there is this common to subjects having all their thoracic organs healthy, and to those affected with *cardiac* (without pulmonary) disease, that the intensity of the heart's sounds will be directly as the distance of the point at which they are examined from their centre of production.

On the other hand, in cases where the heart is healthy, but the lungs diseased, the regular order of propagation is liable to alter, as a result of change in the conducting power of the media intervening between that organ and the surface where auscultation is performed. The positive intensity of sound produced in the heart is unaltered, but its relative intensity as discovered at different parts of the thoracic surface is changed. Upon this fact are founded indirectly some inferences bearing upon the diagnosis of affections of the lungs and pleura.

Thus, whenever the heart's sounds are auscultcd at a given point of the surface, and found to be of greater intensity than at some other spot nearer that organ, the inference is, that the lung or pleura in the *former* situation has either undergone some change rendering them unusually good conductors of sound; or, in the *latter* situation, undergone some alteration diminishing their conducting power. The anatomical state in the first class of cases will be referable to the heads condensation or induration; in the second, to rarefaction. This source of diagnosis has as yet been applied in the investigation of but few diseases; the signs furnished by it are —

Increased intensity of transmission of heart's sounds.

Diminished intensity of transmission of heart's sounds.

b. *Vascular Murmurs.*—Still less than of the cardiac sounds has the modified transmission of vascular murmurs, through tissue of altered conducting power, been made the subject of study. There are, indeed,

but few circumstances under which such transmission is, *à priori*, likely to occur.

Sect. VI. — Succussion.

Under certain circumstances, auscultation, aided by the process of succussion of the patient, discovers a peculiar sound known as that of *thoracic fluctuation.*

The succussion necessary for the production and detection of this phenomenon may be performed by pushing the patient's trunk abruptly (but with gentleness) forwards and backwards, while the observer's ear is applied to the chest; or the patient may himself move his chest once or twice in the manner indicated.

The *sound of thoracic fluctuation* resembles closely that perceived on shaking a decanter, partly filled with water, closely to the ear. Like that, it is a guggling splashing noise, the precise tone of which varies with the density of the fluid, and the proportional quantities of fluid and of air present. It differs in point of intensity according to the suddenness and force of succussion; but may be so easily produced as to be detected on the least movement of the patient, or during coughing.

The sound of thoracic fluctuation may be audible at a distance from the chest, and is both heard and felt by the patient himself; and is, or is not, accompanied with metallic tinkling. Its duration varies greatly, — it may last for years, though this is very rare. It is not invariably a persistent condition when once developed; within twenty-four hours it

may be present and cease to be producible, to recur again within a short period.

SECT. VII. — DETERMINATION OF THE SITUATION OF SURROUNDING PARTS AND ORGANS.

THE object of attempting to determine the situation of other parts than the lungs themselves, when the diseases of these organs are the subject of investigation, is, as might be anticipated, to infer from any change in that situation the existence of some pulmonary affection capable of producing it. Experience has shown that such displacements, so produced, do occur; and further, that when present they are among the most conclusive, and often the most readily ascertained, signs of the pulmonary affection with which they are habitually associated.

The organs and parts liable to undergo displacement in consequence of pulmonary disease are —

1. *The Heart;*
2. *The Mediastinum;*
3. *The Diaphragm;*
4. *The Liver;*
5. *The Spleen;*
6. *The Stomach.*

The existence of displacement of these parts and organs is determined, as has been already said, by means of the other methods of physical diagnosis,— by *inspection*, *by application of the hand*, by *percussion*, and by *auscultation*, very rarely by *mensuration.*

1. The *heart* lies in the anterior mediastinum, with about one third of its substance behind the

lower part of the sternum, and the remaining two thirds immediately to the left of that bone. The apex beats between the cartilages of the fifth and sixth left ribs, "at a point about two inches below the nipple and one inch on its sternal side" (Hope); the base corresponds to the third rib.

The modes of displacement removing it from this situation are —

a. Lateral detrusion { to the right side. / to the left side.
b. Elevation.
c. Procidentia.

a. *Lateral detrusion*, for obvious reasons more readily detected when occurring towards the right side, is then commonly associated with slight procidentia; on the left, with some degree of detrusion, backwards and upwards. The progress of the displacement to the right side is usually gradual from its commencement till it has attained its greatest amount, when the organ pulsates between the fifth and seventh ribs to the right of the sternum. On the left it may be pushed almost under the axilla, its point being at the same time raised the width of an intercostal space, or thereabouts, and carried backwards towards the scapula. [§ 117.]

b. *Elevation* of the heart above its natural level, a displacement of very rare occurrence as a consequence of pulmonary disease, requires no particular description. It has been known to exist to such an amount that the organ pulsated under the second rib. (Stokes.)

c. In *procidentia* of the heart the organ is below its natural level, and carried somewhat towards the

median line; it may beat on the level of the ninth or tenth intercostal space.

2. The *Mediastinum* may be *detruded to the right or left*, under the circumstances productive of lateral displacement of the heart. Percussion is the surest guide in detecting its position.

3. The *Diaphragm.*—The position of the lateral divisions of the diaphragm, and hence the line of boundary between the chest and abdomen, may be ascertained in the healthy state by percussion and auscultation. The dull sound of the liver on the right side, with the beat of the point of the heart, and the amphoric note of the stomach on the left, will guide the observer in the inquiry. But it is maintained by Dr. Edwin Harrison, that the exact situation of the vault of the diaphragm may, in many cases, be more rapidly determined by inspection and application of the hand. The mode of determining the point in question varies according to the shape of the thorax, which is, with reference to this investigation, considered to be of two kinds by Dr. Harrison:—1. If the width of the chest be greater just above, than precisely on, the level of a line drawn transversely across from the lower part of the ensiform cartilage,—in other words, if a slight lateral depression correspond pretty accurately to that level—a very simple method is described by this observer for discovering the position of the upper edge of the diaphragm. Let the hand be passed from below upwards along the side of the chest (its inner edge being kept closely to the surface and the palm somewhat everted), and that inner edge will sink into a narrow sulcus situated

somewhat higher up than the lateral bulging just referred to. This sulcus, which may or may not be on the same level on both sides, indicates the precise height of, and corresponds to, the vault of the diaphragm. 2. If the width of the chest be less immediately above, than on the level of, the ensiform cartilage, this rule will not apply: however, the position of the left half of the septum may then be detected by the beat of the apex of the heart; the right half is at least not lower than its fellow.

One or both divisions of the diaphragm may in certain cases of disease be the subject of *Procidentia*, or *Elevation;* in the former case, the convexity of the diaphragm is inferior.

4, 5, 6. The *liver*, *spleen*, and *stomach* may likewise be raised above or depressed below their natural level; and thus become affected with *Elevation*, or *Procidentia*. These alterations of position are more readily detected in the case of the liver than of the other organs named; and have for this reason attracted more attention on the right than left side.

PART II.

§ 1. — TABLE EXHIBITING THE PHYSICAL CAUSE AND ORDINARY SEAT OF THE DIFFERENT PHYSICAL SIGNS, TOGETHER WITH THE NAMES OF THE DISEASES IN WHICH THEY ARE OBSERVED.

[The signs of greatest practical importance, and also the diseases in which each sign is relatively of most value, are distinguished by *Italics*. The reference attached to each sign is to the page of Part I. in which it is described.]

SECT. I.—SIGNS DISCOVERED BY INSPECTION.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Expansion. (p. 12.)	Gradual and general detrusion of the walls of the chest, by a force acting from within outwards—the elasticity of the lung having been first destroyed.	The left side of the thorax; because its most usual cause (pleuritic effusion) is most common on that side.	*Pleuritic effusion.* Pleuro-pneumonia, § 122. Hydrothorax (extremely rare), § 118. Pneumo-hydrothorax. *Cancer of the pleura or lung.* Hypertrophy of the lung, § 119. *Pneumothorax.* *General hypertrophous emphysema,* § 120. Extensive hæmothorax, § 121. *Pneumonia,* § 122.
Bulging. (p. 12.)	The same cause acting locally.	At either base: oftenest the left.	*Gravitating pleuritic effusion.* Pleuro-pneumonia, § 122. *Cancer of the pleura or lung.*
		Infra-clavicular region. Post-clavicular ... Anterior surface, generally. Mammary and central sternal region.	*Hypertrophous emphysema,* § 123.

		Seat, various. Infra-clavicular region. Right hypochondrium. Post-clavicular region. Infra-clavicular ...	*Circumscribed pleurisy.* *Incipient* tuberculous disease of apex of lung, § 19. Fatty liver, § 124. } Pneumonia of upper lobe, § 122.
Retraction. (p. 12.)	Long-continued pressure having reduced the lung to a very small size, the pleuritic fluid (the compressing material) is removed by absorption; the lung being unable to recover its previous bulk, the chest yields inwards under atmospheric pressure. The false membrane aids materially, through its characteristic force of contraction, in producing this result, by diminishing the bulk of the lung, not, as might be supposed, by actually dragging the wall of the chest inwards.	Most common on left side; for the same reason as expansion.	*General pleuritic effusion*, period of absorption, § 126. Pneumonia, § 127. *Pleuro-pneumonia*, § 127. Tuberculous disease. *Infiltrated cancer of the lung.*

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Depression. (p. 12.)	1. The above causes acting locally.	Seat, various.	*Circumscribed pleuritic effusion*, period of absorption, § 125.
	2. Contraction of pleuritic false membrane alone.	Anterior surface. Antero-lateral ... Posterior ... Postero-lateral ... Anterior and posterior...	*General pleuritic effusion*, § 126. *Pleuro-pneumonia*, § 127.
	3. Diminished volume of portion of lung consequent on changes occurring in its substance after tuberculisation, or local suppuration.	Infra-clavicular region. Post-clavicular ... Upper scapular ...	*Tuberculous disease.* Evacuation of contents of an abscess. (Laennec.) Pneumonia, § 127. Chronic consolidation of the lung.
Procidentia. (p. 12.)	The part lowered has been dragged downwards in consequence of retraction of the corresponding side of the thorax: increased, if lateral curvature of the spine occur.	The shoulder. The ribs, especially at their external aspect. The nipple, § 128.	*Chronic pleurisy with retraction or considerable depression.*
Elevation. (p. 12.)	? § 129.	Shoulder of affected side, § 129.	*Chronic pleurisy with retraction or considerable depression.* (Very rare.)

Lateral Curvature. (p. 12.)	Retraction of the side, and constant "leaning the body towards that side." (Laennec.)	Dorsal spine; convexity more commonly to the right, because left pleurisy more common. The convexity of the curvature is always towards the healthy side. § 130.	*Chronic pleurisy with retraction or considerable depression.*
Distortion. (p. 12.)	Retraction of the side; or local depression.	The ribs, § 131. The clavicle, § 5.	*Chronic pleurisy with retraction or considerable depression.* *Tuberculous disease,* § 5
Diminished motions of expansion and elevation, § 132. (p. 12.)	The instinctive avoidance of pain; paralysis of the muscles naturally producing the motions; a material obstacle in the condition of the pleura or lung.	More obvious at the lower than the upper parts of the chest; and most frequent on the left side.	*Pleurisy at almost all its periods,* § 133. *Pleuro-pneumonia.* Pneumonia, § 134. *Extensive hypertrophous emphysema.* Paralysis. *Pleurodynia.* Hydrothorax. *Pneumothorax.* Phthisis with extensive pleuritic false membrane, § 135.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Increased motions of expansion and elevation. (p. 12.)	Muscular effort to overcome obstruction to the entry of air.	The chest generally.	*Spasmodic asthma*, § 213. Spasm of the glottis. *Obstructive diseases of the larynx and trachea.* *Foreign bodies in air passages.*
Jerking rhythm of motions of expansion and elevation. (p. 13.)	Irregularity of muscular efforts.	The chest generally.	*Spasmodic asthma.* Spasm of the glottis. *Obstructive diseases of the larynx and trachea.* *Foreign bodies in the air passages.* Pleurodynia. Pleurisy in its earliest stage.
Altered rhythm of respiratory act; duration of expiratory movement notably exceeding that of the inspiratory. (p. 13.)	Extreme difficulty in expulsion of air from pulmonary vesicles, in consequence of extensive and general dilatation of these, combined with decrease of the elastic contractility of the substance of the lung.	The chest generally.	*Extensive emphysema.*

Altered relation of movement of expansion to that of elevation; the former more or less proportionally diminished. (p. 13.)	?	Either side of the chest.	*Phthisis with abundant pleuritic false membrane,* § 135. *Pleurisy* { *Extensive effusion;* *Chronic, with retracted side,* § 133. Emphysema. Pneumonia, § 134.
Extent and frequency of the general motions increased; duration and intensity of the respiratory murmurs much diminished. (p. 13.)	Entry of air obstructed; violent muscular efforts made to overcome the impediment.	Chest generally.	*Spasmodic asthma.* *Spasm of the glottis.* *Obstructive diseases of the larynx and trachea.* *Foreign bodies in air passages.*
Diminution of partial or costal motions. (p. 13.)	Mechanical obstruction originating either in the substance of the lung or in the pleura.	Most commonly observed in infra-clavicular and upper part of the mammary regions, on the right side, in phthisis; inferiorly, and on the left side, in pleuritic diseases.	*Tubercles,* § 135. *Emphysema.* Spasmodic asthma. *Pleurisy,* period of { plastic exudation; effusion; retraction. Hydrothorax. *Pneumothorax.* Chronic consolidation of the lung.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Altered relation of costal to general motions; the former much diminished, the latter almost, or wholly unaffected. (p. 13.)	Mechanical obstruction to costal motions; no notable cause of interference with the general motions existing.	Right side of the chest.	*Tubercles*, § 135. Chronic consolidation of the lung.
Fluctuation. (p. 13.)	Movement of fluid contained in the pleura.	Lateral and inferior parts of the chest.	*Pleuritic effusion, with considerable bulging of the intercostal spaces.*

Sect. II. — Signs discovered by Application of the Hand.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Increased vocal and tussive vibration. (p. 16.)	Unnatural density of the pulmonary substance between the bronchi and the part examined.	Infra-clavicular and latero-inferior regions.	*Tubercles.* *Pneumonia.* *Dilatation of bronchi*, § 211. Chronic consolidation of the lung. Pulmonary apoplexy. Pulmonary œdema. (Very slight.)

Diminished vocal and tussive vibration. (p. 16.)	Decreased density of the pulmonary substance between the bronchi and the part examined, and hence decreased power of transmitting vibration from those tubes; or presence of a non-conducting material (air or liquid) in the pleura.	Latero-inferior regions; also infra-clavicular and mammary.	*Pleuritic effusion.* Pleuro-pneumonia, with some amount of effusion. *Pneumothorax.* *Emphysema.* Hydro-pneumothorax. { simple; fistulous. Cancerous infiltration of the lung, with tumour.
Rhonchal vibration. § 136. (p. 16.)	Strong vibratile motion of bronchial tubes communicated by pulmonary substance to the thoracic walls.	Central part of chest.	*Bronchitis, with intense sonorous rhonchus.*
Rubbing vibration. (p. 16.)	Walls of chest set in vibration by friction of pleural false membrane, § 137.	Latero-inferior part of chest.	*Pleurisy*, periods of, { Plastic exudation; Absorption, with or without retraction, § 137.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Pulsatile vibration. (p. 17.)	" Propagation of pulsations of heart through the lung in a semi-fluid condition of the lungs." ? § 138.	Anterior surface of either side.	Pneumonia ? § 138. Cancerous tumour of the lung or pleura.
Simple fluctuation. (p. 17.)	Motion given to fluid by alternate pressure with hands.	Intercostal spaces infero-laterally.	*Pleuritic effusion, attended with considerable bulging of the intercostal spaces.*
" Peripheric fluctuation." (p. 17.)	Wavy motion of fluid in pleura communicated to the fingers by quick sharp percussion of surface.	Intercostal spaces, infero-laterally or about middle height of chest.	*Pleurisy*, periods of, $\left\{ \begin{array}{l} \text{Gravitating effusion;} \\ \text{Effusion with dilatation.} \end{array} \right.$
Fluctuation by succussion. (p. 17.)	Rapid motion of fluid contained in pleura or pulmonary cavity.	Latero-inferior or antero-superior part of chest.	*Hydro-pneumothorax.* *Tuberculous cavity of very large size.*
Rhonchal fluctuation. (p. 17.)	Undulation of fluid in cavity close to surface, produced by air passing through it.	Antero-superior part of chest.	*Tuberculous cavity*, § 139.

Sect. III.—Signs discovered by Mensuration.

A. *General Measurements.*

Circular.

Increased bulk of either side. (p. 21.)	Gradual detrusion of the walls of the chest by a force acting from within outwards,—the elasticity of the lung having been first destroyed by pressure.	The left side of the thorax.	*Pleurisy*, period of effusion with dilatation. *Hydro-pneumothorax.* *Pneumothorax.* *Cancerous tumour of the lung or pleura.* *Hypertrophy of the lung*, § 119. Pneumonia,? § 122. Emphysema, § 140.
Diminished bulk of either side. (p. 21.)	Same as in case of *visible* retraction. [See Inspection.]	The left side of the thorax.	*Pleurisy*, period of absorption with retraction. *Pleuro-pneumonia.* Pneumonia, § 127. Chronic consolidation of the lung. (Rare.) Tubercle, generally first manifest in second stage. Infiltrated cancer of the lung, § 233.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Defective expansion of chest in inspiration, either of one or both sides. (p. 21.)	The instinctive avoidance of pain; paralysis of the muscles producing expansion; or the presence of a material obstacle.	More common on left than right side.	*Pleurisy*, periods of { Effusion; Absorption. *Pleuro-pneumonia.* *Pneumonia.* *Emphysema.* Tuberculous disease; second and third stages. Paralysis. Cancer of the lung or pleura. *Pleurodynia.* Hydrothorax. *Pneumothorax.* *Hydro-pneumothorax.*
ANTERO-POSTERIOR.			
Diameter diminished. (p. 23.)	Diminished bulk of the lung, and consequent falling in of the parietes.	Infra-clavicular region.	*Tuberculous disease of the apex*, especially with abundant false membrane investing the part, § 19. Chronic consolidation of the lung.
		Base of chest.	*Pleurisy*, period of absorption with retraction.

Diameter increased. (p. 23.)	Increased bulk of the corresponding part of the lung from presence of various morbid matters.	Infra-clavicular region? § 19.	*Tuberculous disease of the apex,* at its very earliest stage? § 19.
		Base of chest.	*Pleurisy, with considerable effusion.* *Cancerous accumulation of considerable amount in lungs or pleura.* *Extensive hypertrophy of lung.*
VERTICAL.			
Vertical measurement increased. (p. 23.)	Extensive liquid or solid accumulation in chest.	Front of chest.	*Pleurisy,* with very abundant effusion. *Cancerous masses of large size in lungs or pleura.*
Vertical measurement decreased. (p. 23.)	Retraction of side; itself produced as explained at p. 85. Although elevation of the diaphragm, and consequently diminished vertical height of the thoracic *cavity* on either side, is common in cases of absorbed effusion, decrease of this measure on the *surface* is rare.	Front of chest.	*Pleurisy,* period of absorption with retraction.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
	B. *Partial Measurements.*		
	HORIZONTAL.		
Distance between nipple and middle line diminished. (p. 24.)	External parts of the chest brought nearer its central axis by the process of retraction.	Most common on left side.	*Pleurisy*, period of absorption with retraction.
Distance between nipple and middle line increased. (p. 24.)	External parts of the chest detruded from its central axis by solid or fluid accumulation within it.	Most common on left side.	*Pleurisy*, period of effusion with dilatation, when the latter is very considerable. *Cancerous accumulation, if very extensive.*
	VERTICAL.		
Distance between the clavicle and nipple increased. (p. 24.)	Dragging downwards of the upper part of the chest during the process of retraction.	Most common on left side.	*Pleurisy*, period of absorption with retraction, § 20.
Distance between the nipple and iliac spine, and the 12th rib and that spine decreased. (p. 24.)	Dragging downwards of the lower part of the chest during the process of retraction.	Most common on the left side.	*Pleurisy*, period of absorption with retraction.

SECT. IV. — SIGNS DISCOVERED BY PERCUSSION.

Diminution of clearness and of duration of sound (dull sound), with increased resistance of walls. (p. 87.)	Increased density of the subjacent parts, and diminished quantity of air in the corresponding pulmonary tissue.	All regions of the chest; but the bases and summits anteriorly and posteriorly more frequently than the central and lateral regions.	Bronchitis, with very extensive muco-purulent accumulation in the bronchi. (Very rare.) *Dilatation of the bronchi*, § 141. *Congestion of the lung*, if considerable. *Œdema of the lung.* *Pneumonia*, acute and chronic; former in the three stages. Pulmonary apoplexy. *Tuberculous disease* in all its stages. Cancer of the lung or pleuræ. Chronic consolidation of the lung. *Pleurisy*, periods of { plastic exudation; effusion; retraction. *Pleuro-pneumonia.* *Hydrothorax.* *Hydro-pneumothorax*, lower parts of the chest. Hæmothorax. Spasmodic asthma, during the paroxysm, § 214.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Increase of clearness and of duration of sound, with decreased resistance of walls. (p. 37.)	Diminished density of subjacent parts, and increased proportion of air within the chest.	Superior regions of the chest, anteriorly and laterally.	*Pneumothorax.* *Hydro-pneumothorax*; upper parts of the chest. Atrophy of lung. Hypertrophy of lung. *Emphysema* { atrophous; hypertrophous. General anœmia, § 34. Emaciation of walls of chest. § 34.
Increase of clearness and of duration of sound, with increased resistance of walls. (p. 37.)	Increased quantity of air in the subjacent part, with considerable induration of tissue between the surface and the part (cavity) containing the excess of air.	Infra-clavicular regions.	*Tuberculous cavity near the surface, having its anterior wall thin, indurated, and adherent,* §§ 21. 32. 142.
Wooden character of sound. (p. 38.)		Infra-clavicular or inferior regions; most common in the former.	*Chronic pleurisy, whether simple or tuberculous*, with dense pseudo-membranous matter forming a solid stratum between the walls and lung, § 10.

Tympanitic character of sound. (p. 38.)	Unnaturally abundant quantity of air in the subjacent parts, together with increased tension of the walls.	Left infra-clavicular and mammary regions; also axillary and infra-axillary on either side.	*Pulmonary emphysema* { atrophous; hypertrophous. Pulmonary atrophy. *Pneumothorax.* *Hydro-pneumothorax.*
Tubular character of sound. (p. 38.)	Any condition which brings the larger bronchi unnaturally near the surface, and so within the reach of percussion; or the presence of a solid substance between those bronchi and the surface.	Lower part of infra-clavicular and upper part of mammary regions; most frequently observed on the left side.	*Pleuritic effusion* { general (period of retraction), § 41. partial, § 41. Accumulation of pus retained and lying over bronchi, § 229. Pneumonia. (Very rare.) § 41. Dilatation of bronchi. *Tuberculous cavity of small (rarely of large) size.* Chronic consolidation of lung. Cancerous mass round bronchi.
Amphoric character of sound. (p. 38.)		Antero-superior part of chest on either side.	*Tuberculous cavity of large size,* having walls generally and equably condensed.
Cracked-metal character of sound. (p. 38.)	Sudden propulsion of air (forcibly expelled from a cavity) against the walls of the passages with which it comes in contact, § 43.	Antero-superior part of chest on either side.	*Tuberculous cavity of large size,* with anfractuous walls, and communicating freely with the bronchi; the corresponding parietes being at the same time particularly yielding, Bronchitis ?, § 205.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed
Moveableness of the limits of dulness of sound. (p. 39.)	Moveableness of the material causing the dull sound.	Inferior regions of the chest.	*Pleurisy*, especially at period of gravitating effusion. Hydrothorax. *Hydro-pneumothorax.*
Comparatively deficient increase of clearness at the close of a full inspiration. (p. 40.)	Interference with complete expansion of the lung.	Either infra-clavicular region.	*Slight irregularly disseminated induration, tuberculous or other.* § 143.
Comparatively great diminution of clearness at the close of full expiration. (p. 40.)	Reduction of size of the lung on expiration, bringing within a small space foreign matter which had previously been more widely scattered.	Either infra-clavicular region.	*Slight accumulation of tuberculous matter, scattered through the apex*, § 143.
Comparatively deficient diminution of clearness at the close of full expiration. (p. 40.)	Stagnation of air in the lungs or presence of air in the pleura.	Mammary region on left side; but may be general.	*Emphysema* { atrophous. / hypertrophous. } *Obstruction of bronchus of large size*, from foreign body, inspissated mucus, &c. *Pneumothorax.*

nary sound scarcely reduced at close of full expiration. (p. 41.)	lungs.	and right inferior regions.	hypertrophous. *Obstruction of chief bronchus from foreign body, inspissated mucus,* &c.

Sect. V. — Signs discovered by Auscultation.

Exaggerated respiration, § 141. (p. 52.)	More rapid circulation of air through the lung, together with an increase in its quantity and the force of its impulse against the walls of the vesicles; all this being the result (except in very rare cases) of the inaction of some part of the same or of the other lung.	Very variable; frequently the entire of either side of the chest, § 72.	1. In healthy tissue adjoining parts { *Obstructed by* Bronchitis. *Foreign body in the principal bronchus*, § 145. *Condensed by* *Tubercle.* Apoplectic effusion. *Pneumonia*, § 146. *Pleuritic effusion.* *Intra-thoracic tumours.* Chronic consolidation. *Rarefied by* Vesicular emphysema, § 147. 2. In healthy tissue suddenly released from spasm. } Spasmodic asthma. 3. In tissue affected with { Hypertrophy, § 148. Earliest stage of pneumonia ?, § 148.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed
Weak respiration. (p. 52.)	Existence of an obstruction to the entry of air into the part in which it exists.	Variable; limited to a spot in one lung, or apparent over entire of both lungs.	1. SUPERFICIAL VARIETY, § 149. a. Persistent. *Obstructive diseases of the larynx and some of the pharynx.* *Narrowing or obliteration of bronchus by* Contraction. Thickening of mucous membrane. Accumulated mucus. Hypertrophy of longitudinal fibres, § 150. *Pressure of tumours, cancerous or other.* Bronchitis. *Chronic consolidation of the lung, or infiltration with tubercle or other morbid product in a limited space.* *Vesicular emphysema.* Pneumonia. Previous to engorgement. § 146. After resolution. Pulmonary œdema. Pulmonary apoplexy. Imperfect respiratory movements from paralysis. b. Intermittent. *Pleurodynia.* *Pleurisy.* Dry stage. Stage of plastic exudation.

			Spasm of the glottis. *Spasmodic asthma.* *Foreign bodies in the air passages.* 2. Deep-seated Variety. *Pleurisy*, period of laminar effusion. *Hydrothorax* to a moderate extent. *Pneumothorax* ...
Suppressed respiration. (p. 53.)	Existence of a complete obstruction to the entry of air into the part in which it exists.	Variable; the whole or part only of a lung.	*Complete obliteration of a bronchus by any of the causes above enumerated.* (Plug of hardened mucus in large bronchus; Andral.) In *very rare* cases, infiltration of the lung with tubercle, "matter of induration," or other morbid productions.* *In rare cases of vesicular emphysema.* Extremely thick plastic matter in pleura. *Pleurisy*, with abundant effusion. Hydrothorax. *Pneumothorax*, when considerable. Bronchitis. *Spasmodic asthma;* during very intense paroxysms. Pulmonary apoplexy, if extensive. * [It is probable that the respiratory murmurs are actually more or less extensively suppressed in almost all cases of this class; but it is, for obvious reasons, in rare instances only that the suppression can be detected.]

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Incomplete respiration. (p. 53.)	Some mode of partial obstruction to the entry of air, not yet accurately defined, § 151.	Lower parts of the chest; infra-mammary, infra-axillary, and infra-scapular regions.	1. Inspiration deficient at close: *Spasmodic asthma.* Hepatization of the lower portion of the lung. Moveable plug of tough mucus in bronchi. Certain cases of incipient pleurisy. 2. Inspiration deficient at outset: Bronchitis with much obstruction of tubes. Pleuritic effusion with *dilatation* of side.
Jerking respiration. (p. 53.)	Interference with continuous expansion of chest, either from *pain* or, under certain circumstances, from the *presence of pleuritic adhesion.*	Entire of one side or infra-clavicular region only.	General: *Incipient pleurisy. Pleurodynia. Spasmodic asthma.* Partial: *Certain cases of tuberculous infiltration* [with corresponding pleuritic adhesion?], § 152. Certain cases of chronic pleurisy with adhesion.

(p. 54.)	state of the air-cells interfering with expulsion of air in expiration.		
Harsh respiration. (p. 54.)	Condensation or rarefaction of pulmonary substance, and dryness of the mucous membrane of the bronchi.	Infra-clavicular regions in tuberculous cases; variable in others.	*Incipient tuberculisation of lung.* Dry bronchitis. *Vesicular emphysema.* *Chronic pulmonary consolidation.* *Dilatation of bronchi.* *Incipient cancerous infiltration of lung.* Lung slightly compressed by plastic or tuberculous matter in the pleura. Pneumonia, period of resolution. Pleurisy, in parts of lung { underneath laminar effusion. / above gravitating effusion. / beside effusion with dilatation. / compressed during absorption. Pulmonary apoplexy.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Bronchial respiration. (p. 54.)	Condensation of the pulmonary substance.	Same as harsh respiration.	*Chronic pulmonary consolidation.* *Incipient tuberculisation of lung.* *Dilatation of bronchi.* *Pulmonary apoplexy.* *Incipient cancerous infiltration of lung.* *Pleuritic effusion:* while unadvanced, opposite the seat of the effusion; when advanced, opposite the parts not surrounded with fluid. *Hepatisation* of moderate density and extent.
Blowing respiration: diffused variety. (p. 55.)	Considerable condensation of pulmonary substance [acting principally upon the smaller bronchi?]. § 153.	Upper and middle parts of the chest.	*Pneumonia;* stages of hepatisation, § 153. *Tubercles.* *Pleuritic effusion.* (Rare.) § 219. *Dilatation of bronchi.* Chronic pulmonary consolidation. Cancerous disease of lung or pleura.

Blowing respiration: tubular variety. (p. 55.)	Extremely dense solidification, by which minute bronchi obliterated and sound transmitted directly from large ones?. § 153.	Middle and rarely upper parts of the chest.	*Pneumonia*, stages of hepatisation, § 153. Pulmonary abscess; pus retained. Solid adventitious mass in pleura, pressing down tissue of lung towards bronchi.
Cavernous respiration. (p. 56.)	Passage of air through an unnatural hollow space in the interior of the lung, § 154.	Summit of one or both lungs.	*Tuberculous excavation.*
		Central part of lung most commonly.	*Extensive dilatation of bronchi.*
		Indifferently in any part of the lung.	Excavation from *Abscess.* Sphacelus. Communication of pus contained in pleura or elsewhere with bronchi; some destruction of substance attending, §§ 171. 174. *Softening of cancer.* Pulmonary apoplexy.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Amphoric respiration. (p. 56.)	A very large space, empty or nearly so, within the chest, and communicating by a moderately wide opening with the air-passages, — that communication existing above the level of any fluid present in the space referred to, § 198.	Latero-posterior part at central height on either side most commonly; rare at the upper part of the chest; extremely rare at the base of the lung.	1. *Broncho-pleural fistula*, produced by — a. Rupture from lung into pleura of — *Tubercle.* Sphacelated tissue. Emphysematous vesicles. (Very rare.) b. *Passage from pleura into bronchi of*— *Pus, formed in pleura (empyema).* *Pus*, conveyed from other parts. 2. *Excavation of large size in the lung*, from — *Tuberculous disease.* Sphacelus. Abscess. [It is *possible* that evacuation of cancerous matter from the lung might occur to a sufficient amount to give rise to amphoric respiration, but this has never been *observed.*]

(p. 58.)	mueus in, and modifying the form and caliber of, the bronchi temporarily, and itself becoming the seat of vibration, which is transmitted to the tubes, § 155. 2. Permanent alteration of caliber of bronchi from external pressure.	both sides of the chest, or in other cases limited to some spot in particular, the site of which is variable.	*a.* Primary *b.* Intercurrent or Secondary to { Emphysema, § 157. Pulmonary caverns, § 158. Dilated bronchi, § 159. Pneumonia, § 160. } *c.* Acute. *d.* Chronic, § 161. *e.* Simple. *f.* Plastic. *Pulmonary emphysema*, § 157. Tumours pressing on bronchi, § 155.
Sonorous rhonchus. (p. 58.)	Presence of viscid mucus in, and modifying the form and caliber of, the bronchi (§ 162.), and itself becoming the seat of vibration. 2. Permanent alteration of caliber of bronchi from external pressure.	Same as the sibilant.	Same as the sibilant; the precise conditions of the diseases vary commonly in the two cases however, §§ 155. 162.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed
Dry crackling rhonchus. (p. 59.)	? § 163.	Wherever tubercle exists in the first stage; hence, in the great majority of cases the summit of the chest anteriorly and posteriorly,—that is, *primarily*; it may appear *secondarily*, however, in a lower situation, when the disease has advanced to the second stage superiorly. It has not yet been detected as a primary condition in those rare cases in which tuberculisation commences inferiorly, § 164.	*Unsoftened tubercle in moderate quantity*, § 164.
Crepitant rhonchus: a. *Primary.* (p. 59.)	? § 165.	Varies with that of the pneumonia, according as this is idiopathic or symptomatic. In the former case one base posteriorly is its most common seat, § 166.	*Pneumonia*; stage of engorgement, both in idiopathic and symptomatic species, § 167.

Crepitant rhonchus: b. *Redux.* (p. 60.)	? § 97.	The same as of the primary variety.	*Pneumonia;* period of resolution, § 97.
Subcrepitant rhonchus. True subcrepitant variety. (p. 60.)	Bubbling of air through liquid of variable consistence in minute bronchial tubes, § 237.	Bases of both lungs posteriorly, § 168.	*Idiopathic capillary bronchitis.*
		Summit of either lung, § 169.	*Tuberculous capillary bronchitis.*
		Basis of one lung posteriorly most commonly.	*Pneumonia*, at period of resolution, § 97.
Subcrepitant rhonchus. Liquid subcrepitant variety. (p. 61.)		Circumscribed points of the chest of variable seat.	*Pulmonary apoplexy.*
		Bases of both lungs posteriorly.	*Pulmonary œdema.* Idiopathic. Following pneumonia, § 97.
		Basis of one lung posteriorly most commonly.	Chronic consolidation of the lung, in its very earliest period of transition from acute.
Subcrepitant rhonchus. Continuous variety. (p. 61.)		Basis of one lung posteriorly.	Active pulmonary congestion?
Humid crackling rhonchus. (p. 61.)	? § 170.	Summit of either lung.	*Tubercles commencing to soften.*

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Mucous rhonchus. (p. 61.)	Bubbling of air through liquid (mucus, blood, pus) contained in tubes of moderate or considerable caliber.	Middle height of both, or more rarely of one lung.	*Bronchitis* { acute. chronic. *Bronchorrhœa.* *Dilatation of bronchi.* *Bronchial hæmorrhage.* *Pulmonary apoplexy* (with hæmoptysis). Evacuation of pus from pleura or elsewhere through bronchi. § 171. Third stage of pneumonia? § 172.
Cavernous rhonchus. (p. 62.)	Bubbling of air through fluid contained in a hollow space in the interior of the lung (§ 99. 154.); or, in very rare cases, motion of fluid so contained, produced by the action of the heart. § 173.	Summit of one or both lungs. Central part of lung most commonly. Indifferently in any part of the lung.	*Tuberculous excavation.* *Extensive dilatation of bronchi.* Excavation from Abscess. Sphacelus. Communication of pus contained in pleura or elsewhere with bronchi; some destruction of substance attending, § 171. 174. Softening of cancer. Pulmonary apoplexy.

(p. 64.)	their natural polished smoothness and slight humidity, and become more or less rough from the deposition of new matter, § 176. The collision is commonly produced by the movements of respiration; in very rare instances, by the action of the heart, § 176.	day to day in the same subject, § 177.	generally tuberculous, § 178.
Rubbing friction sound. (p. 65.)		When the cause is idiopathic pleurisy, the central height and inferior part of the chest posteriorly and laterally; when the cause is tuberculous pleurisy, sometimes the summit, § 104. 177. In cases of advanced emphysema at the postero-inferior part of the chest (?).	*Pleurisy.* 1. Period of plastic exudation. 2. Period of effusion, § 179. 3. Period of absorption, with or without contraction of the chest. (Redux.) *Superficial pneumonia with plastic exudation*, § 176. Pulmonary emphysema with sub-pleural vesicles, § 180. Sub-pleural tubercles, § 181.
Grating friction sound, § 175. (p. 65.)			*Pleurisy.* Period of plastic exudation. Period of absorption with or without contraction of the chest. (Redux.)
Creaking friction sound. (p. 65.)			*Pleurisy*; period of absorption with or without contraction of chest. (Redux.)

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Harsh laryngeal respiration. (p. 66.)	Passage of air along the surface of rough or ulcerated mucous membrane; also through a larynx the form of which is altered by external pressure.	Opposite the larynx, extending into the trachea to a certain distance.	*Acute* and *chronic laryngitis*, with or without ulceration or diminution of caliber of tube. *Tumours pressing upon the larynx or trachea from without*, § 182 Croup.
Sibilant laryngeal rhonchus. (p. 66.)	Passage of air through a larynx of diminished caliber.	Over the larynx and lateral parts of the neck; sometimes audible at the upper part of the chest, and even without applying the ear or stethoscope to that cavity.	*Spasm of the glottis.* *Laryngismus stridulus.* *Hooping-cough.* *Œdema of the glottis.* *Foreign bodies in the air passages.* *Tumours compressing the larynx or trachea.*
Sonorous laryngeal rhonchus. (p. 66.)	Passage of air through larynx of diminished caliber.	Same as the sibilant.	*Laryngeal ulcerations with thickened edges.* *Laryngeal vegetations.* *Croup*, § 108. Tumours either connected with the larynx itself, or pressing upon it from adjoining parts.

[illegible] *laryngeal rhonchus.* (p. 66.)	:	Most evident immediately above the alæ of the thyroid cartilage; disappears below in the bronchial tubes, and may even exist on one side only of the larynx. (Stokes.)	*Chronic laryngitis with ulceration.*
Gurgling laryngeal rhonchus. (p. 67.)	Passage of air through fluids contained in the larynx.	The larynx and trachea; audible sometimes at a distance.	*Hæmoptysis*, § 183. *Laryngeal ulcerations*, § 184. *Foreign bodies in larynx or trachea*, § 185. Close of life in various diseases (death-rattle).
Flapping laryngeal rhonchus. (p. 67.)	Tremulous movement of false membrane, produced by the air passing to and from the lungs.	Opposite the larynx or along the trachea, and audible even in the larger bronchi also, § 186.	*Croup, with floating false membrane, partially attached*, § 186.
Weak vocal resonance. (p. 71.)	Diminished conducting power of substance of lung, or presence of non-conducting medium between the lung and the walls of the chest.	Anterior surface of either side (especially the left); also the bases posteriorly.	*Atrophous vesicular emphysema*, § 187. *Pneumothorax.*

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Suppressed vocal resonance. (p. 71.)	Presence, in the cavity of the pleura, of a material incapable of conducting sonorous vibrations (air).	Middle height of chest.	*Extensive pneumothorax*, § 188.
Bronchophony. (p. 71.)	1. Unnatural density of the pulmonary tissue surrounding the bronchi, and forming the medium of transmission between those tubes and the surface, in consequence of which density the substance is rendered a better conductor of sound, § 189.; 2. presence of an indurated adventitious mass in the same situation; 3. enlarged caliber of the bronchi, § 189.	Summit.	*Tuberculous accumulation.*
		Base posteriorly commonly; sometimes the summit.	*Pneumonia, periods of hepatisation.*
		Central height usually.	Pleurisy. Period of effusion, laminar and gravitating, § 190. Period of absorption without contraction of chest. (Rare.) Period of absorption with contraction of chest. (Frequent.) *Pleuro-pneumonia.* *Dilatation of bronchi*, § 189.
		Variable.	*Cancerous disease of lung or pleura.* Tuberculous masses in pleura. *Pulmonary apoplexy.* (Rare.) Chronic consolidation of lung.

Ægophony. (p. 72.)	A thin stratum of liquid compressing the lung, and commonly (but not necessarily) contained in the pleura, § 191.	The neighbourhood of the inferior angle of either scapula (rarely of both) and a few inches on the side in a line with that point; in very rare cases extending towards the nipple in front, § 192.	*Pleurisy, period of* { *laminar*, § 282. / *gravitating*, } *effusion.* / *absorption* (Redux). *Hydrothorax*, § 193. Hydropericardium (extremely rare), § 194. *Pleuro-pneumonia*, § 195. Pneumonia, § 195.
Pectoriloquy. (p. 72.)	The existence of a hollow space in the lung, presenting certain conditions conducive to free vibration, §§ 115. 196.	Summit of one or both lungs. Central part of lung most commonly. Indifferently in any part of the lung.	*Tubercular excavation*, § 196. *Dilatation of bronchi.* Excavation from { Abscess. / Sphacelus. / Pulmonary apoplexy. / Cancer.
Amphoric resonance. (p. 73.)	The existence of a large cavity in the lung, filled chiefly with air, and communicating with the bronchi.	Same as amphoric respiration.	

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Bronchial cough. (p. 74.)	Unnatural density of pulmonary substance; compression by fluid; enlarged caliber of the bronchi.	Summit. Base posteriorly, and opposite root of the bronchi. Central height.	*Tuberculous disease.* *Pneumonia.* *Pleurisy*, § 197. *Dilatation of bronchi.* Chronic consolidation of the lung.
Cavernous cough. (p. 74.)	The same as cavernous respiration; p. 107.		
Amphoric cough. (p. 75.)	The same as amphoric respiration; p. 108.		
Metallic tinkling and echo. (p. 75.)	§ 198.	Central height laterally or posteriorly, whence it may be propagated with gradually diminishing intensity to the surrounding parts; may be heard in every part of the chest, § 199.	*Pneumo-hydrothorax, with bronchial fistula.* *Excavation in the lung*, with indurated walls, of extremely large size; especially if multilocular, and containing about equal proportions of air and fluid: of tuberculous origin. (Rare.) Pneumo-hydrothorax without bronchial fistula. (Extremely rare.) § 198. Pneumothorax (?). § 200

Intensity of heart's sounds, as transmitted through the lung, increased. § 201. (p. 77.)	Increase of conducting power of pulmonary substance, or deposition of good conducting material in the cavity of the pleura.	Always more readily ascertainable on the *right* side; the part of that side variable.	*Pneumonia.* *Chronic consolidation of lung.* *Tuberculous disease in first and second stage*, § 201.; occasionally in third. Extensive pulmonary apoplexy. Pleurisy. { Period of effusion (laminar; gravitating). Period of absorption with retraction. *Dilatation of bronchi.* *Cancerous disease of the lung.* Pulmonary œdema, if producing much induration. Tuberculous masses in pleura.
Intensity, as above, diminished, § 202. (p. 77.)	Diminished conducting power of contents of chest, dependent on rarefaction of lung or presence of air in pleura.	More readily ascertainable on the *left* side; the part of that side variable.	*Pulmonary emphysema*, § 202. Pulmonary atrophy. *Pneumothorax.*
Transmission of vascular murmur through the lung, § 203. (p. 77.)	The existence of the murmur, and of an unnaturally good conducting medium to transmit it.	Under the clavicle, and originating in the subclavian artery.	Tuberculous disease of apex, § 203. Chronic induration of apex, § 203.

SECT. VI. — SIGN DISCOVERED BY SUCCUSSION.

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Sound of thoracic fluctuation. (p. 78.)	Produced by violent collision of air and liquid in a space of large dimensions, § 223.	At the postero-lateral part of either side.	*Pneumo-hydrothorax with pulmonary fistula.* Pneumo-hydrothorax without fistula. (Very rare.) § 41. Tuberculous cavity of very large size.

SECT. VII. — DISPLACEMENTS OF SURROUNDING PARTS AND ORGANS.

1. *The Heart.*

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
Detrusion towards the right side. (p. 80.)	Considerable solid or fluid accumulation in the *left* pleura, or emphysematous enlargement of the *left* lung *pushing* the organ in that direction; also rapid absorption of fluid in the *right* pleura, or gradual contraction of substance of right lung.	Behind, or to the right of, lower part of sternum.	*Pleuritic effusion* Hydrothorax *Emphysema* *Cancerous accumulation* *Pneumothorax* *Hydro-pneumothorax* } of *left* side. *Pleuritic effusion rapidly absorbed* General consolidation with marked contraction of lung } of *right* side.

	cy to a vacuum on that side, by means of which the organ is *drawn* in that direction.		
Detrusion towards the left side. (p. 80.)	The same, *mutatis mutandis*, as in the case of displacement towards the right side.		
Elevation. (p. 80.)	Diminished volume of upper part of lung from atrophy; also from contraction, both interstitial and of investing false membrane.	Infra-clavicular regions.	Tuberculous disease of apex.
Procidentia. (p. 80.)	Enlargement of both lungs, pushing the diaphragm downwards, and with it the heart.	Epigastrium.	*Emphysema of both lungs.*
	2. *Mediastinum.*		
Detrusion to the right or left side. (p. 81.)	The same, *mutatis mutandis*, as in the case of displacement of the heart towards the right or left side.		

Name of the Sign.	Physical Cause of the Sign.	Ordinary Seat of the Sign.	Diseases in which it is observed.
3. *Diaphragm.*			
Either division the subject of procidentia. (p. 82.)	Mechanical pressure from above downwards.	Most common on left side, because pleurisy there most common.	*Pleuritic effusion.* Hydrothorax. (Very rare.) *Emphysema.* (Not common.) *Cancerous accumulation.* *Pneumothorax.* *Hydro-pneumothorax* { simple. fistulous.
Either division the subject of elevation. (p. 82.)	Force of suction existing on the same side of the chest.	As above.	*Absorbed pleuritic effusion*, with marked contraction of lung. *Phthisis with diminished volume of the lung.*
4, 5, 6. *Liver, Spleen, and Stomach.*			
Procidentia or elevation of these organs. (p. 82.)	The same as in the case of each division of the diaphragm.		

PART II.

§ 2. — SYNOPSIS OF THE PHYSICAL SIGNS OF DISEASES OF THE LUNGS.

BRONCHITIS.

a. *Idiopathic general Bronchitis, Acute and Chronic.*

Application of the hand. Rhonchal vibration, if intense sonorous rhonchus be present. [§ 136.]

Percussion. Diminution of clearness of sound in lower and posterior regions, if there be very considerable accumulation of mucus or muco-pus in the bronchi [§ 204.]; *unless under these circumstances sound not perceptibly affected.* [§ 205.]

Auscultation. Respiratory murmurs weak or even temporarily suppressed in the tissue immediately corresponding to the affected tubes; exaggerated in that adjoining, hence especially so in the upper parts of the chest; *respiratory murmurs dry and harsh;* respiration occasionally incomplete: *sibilant and sonorous rhonchi, the former chiefly heard in inspiration, the latter in expiration; mucous rhonchus.* [§ 206.] *When the rhonchi are intense, they may mask the respiratory murmurs altogether.* [§ 207.]

b. *Idiopathic Capillary Bronchitis.*

In addition to the signs belonging to bronchitis generally, (and it is to be understood that the dry rhonchi existing in the larger tubes may be absent altogether, or nearly so, in this variety of the disease,) there is discovered by

Auscultation. True subcrepitant rhonchus at both bases posteriorly; fine mucous rhonchus higher up. [§ 168.]

Dilatation of the Bronchi.

a. *Idiopathic or Primary.*

Application of the hand. Increased vocal and tussive vibration. [§ 211.]

Percussion. Diminution of clearness, with shortened duration of sound, and increased resistance of walls: except in cases of extreme rarity. [§ 141.] Sometimes the *character of the sound distinctly tubular.*

Auscultation. Respiratory murmurs harsh, bronchial, diffused blowing or (if extensive) *cavernous; dry* and *humid rhonchi of bronchitis* [§ 159.], or (if extensive) *cavernous rhonchus; bronchophony* [§ 189.], or *pectoriloquy; bronchial or cavernous cough: intensity of transmission of heart's sounds increased.* [§ 208.]

b. *Symptomatic or Secondary.*

1. *Of chronic pleurisy.*

The same as in the idiopathic variety, with, in

addition, the signs of pleurisy terminating in retraction of the side. [§ 209.]

2. *Of acute pneumonia.* [§ 210.]

The physical signs are masked by those of the disease with which the dilatation is associated.

Narrowing or Obliteration of the Bronchi.

a. *General and Uniform Narrowing.*

Auscultation. Respiratory murmurs weak and harsh on the affected side, exaggerated on the other; sonorous and sibilant rhonchi.

b. *Limited to a single Bronchus.*

Auscultation. Respiratory murmurs suppressed over an extent depending upon the size of the obliterated bronchus; exaggerated respiration elsewhere; sonorous and sibilant rhonchi.

Vesicular Emphysema.

a. *Hypertrophous Variety.*

Inspection. General expansion, giving a globular form to the chest if it exist on both sides [§ 120.]; *bulging of the infra-clavicular, post-clavicular, mammary, and central sternal sub-regions, or of the anterior surface generally* [§ 123.]; *diminished motion of expansion and elevation;* and consequently of *retraction and depression; duration of expiratory movement considerably exceeding that of the inspiratory;* movement of

expansion diminished as compared with that of elevation: costal motions diminished. [§ 212.]

Application of the hand. *Vocal and tussive vibration diminished.*

Mensuration. *Semicircular measurement of one side, or of the whole chest, increased* [§ 140.]; increase of bulk under expansion of thorax in inspiration less than natural.

Percussion. *Increase of clearness* and of duration *of sound; resistance of walls decreased; character of sound more or less tympanitic;* comparatively deficient diminution of clearness of sound at the close of a full expiration; limits of pulmonary sound scarcely reduced at the close of a full expiration.

Auscultation. *Respiration weak*, in very rare cases suppressed in the affected part, *exaggerated in those adjoining* [§ 147.]; *rhythm of the respiratory act divided; murmurs harsh*, with *expiration more or less, sometimes enormously prolonged*, and in some cases absent altogether, although inspiratory murmur apparently audible [§ 231.]; *sibilant, sonorous, mucous, or subcrepitant rhonchi*, from accompanying bronchitis; vocal resonance unaltered or weaker than natural; intensity of transmission of heart's sounds through the affected part diminished.

Situation of surrounding parts. *Heart detruded towards the opposite side, if one lung only affected; downwards towards the epigastrium, if both are implicated; mediastinum de-*

truded to the opposite side; either division of the diaphragm pushed downwards with the subjacent abdominal viscera, — this in some cases only.

b. *Atrophous Variety.*

The signs derived from *application of the hand* and from *percussion* are the same in this as in the hypertrophous variety; the *auscultatory signs* differ only in the distinct *weakness of vocal resonance* discovered in the atrophous form of the disease; by *inspection* the *expansion* and *bulging*, forming such important characters of the hypertrophous variety, are found either *to be wanting or to exist to a much less degree* in the present form [§ 123.]; the *circular* or *semicircular bulk of the thorax is not increased*, and the *surrounding parts and organs are found to have undergone no obvious displacement.*

Interlobular and Subpleural Emphysema.

Unless when the result of sudden rupture of the vesicles from internal or external violence, these forms of emphysema are invariably associated with the vesicular species, most commonly its atrophous variety. The signs in cases of the interlobular and subpleural forms are then fundamentally those of the vesicular. Whether two signs described by Laennec as peculiar to the former (dry crepitant rhonchus with large bubbles, and pleural friction sound) can be admitted to have the signification he

has assigned them is a point made the subject of discussion elsewhere. [p. 63. and § 180.]

SPASMODIC ASTHMA.

During the Paroxysm.

Inspection. Increased motions of expansion and elevation [§ 213.]; *jerking rhythm of these motions; extent and frequency of the general motions increased, while the duration and intensity of the respiratory murmurs are much diminished; diminution of the costal motions.*

Percussion. Sound slightly diminished in clearness and duration. [§ 214.]

Auscultation. Intermittent, weak, or suppressed respiration, alternating with exaggerated respiration; the latter occasionally accompanied with the *dry rhonchi of bronchitis; rhythm of respiratory murmurs jerking, sometimes incomplete, inspiration being deficient at the close.*

ACUTE PNEUMONIA.

a. *Of a considerable Mass of the Lung.*

The question whether the existence of pneumonic inflammation can be detected by physical signs, before the stage of engorgement has supervened, and if so, what those signs are, is elsewhere examined [§ 146. 148.]; the three admitted stages only of the disease, together with the phenomena of resolution, will be considered here.

First Stage — Engorgement.

Inspection. Diminution of motions of expansion and elevation (if severe pain be present). [§ 134.]

Percussion. Sound less clear than natural, resistance slightly increased.

Auscultation. Respiratory murmurs weak, suppressed or masked by rhonchus in the affected parts; exaggerated in those at some distance from it and in the opposite lung; true crepitant rhonchus; vocal resonance somewhat increased; some degree of bronchial cough.

Second Stage — Red Hepatization.

Inspection. Expansion of the affected side [§ 122.]; bulging of the infra-clavicular sub-region in pneumonia of the upper lobe [§ 122.]; diminution of the motions of expansion and elevation [§ 134.]; motion of expansion diminished in proportion to that of elevation. [§ 134.]

Application of the hand. Increased vocal and tussive vibration; pulsatile vibration ?. [§ 138.]

Mensuration. Increase in the semicircular measurement of the side [§ 122.]; deficient increase in semicircular width in inspiration.

Percussion. Sound diminished in clearness, until completely dull, decreased in duration, sense of resistance very much increased; under certain circumstances of locality of the inflammation, *character of the sound tubular.* [§ 41.]

Auscultation. *Respiration bronchial*, or *blowing*, *of either the diffused or tubular varieties* [§ 153.]; weak in the immediate vicinity of the inflamed part (Grisolle) [§ 146.]; *exaggerated in more distant parts and in opposite lung; bronchophony*, or, under certain circumstances, *broncho-ægophony; bronchial cough; intensity of transmission of heart's sounds increased.*

Third Stage — Grey Hepatization, or *Interstitial Suppuration.*

The signs in this stage are the same as in the preceding one; facts observed of late years tend to render it probable that the occurrence of a peculiar form of mucous rhonchus, in addition to the signs of the second, may announce the supervention of the third, stage.

Stage of Resolution.

Inspection. Retraction or depression of the affected side. [§ 127.]

Mensuration. Diminution of semicircular width. [§ 127.]

Percussion. *Dulness of sound less marked than previously and gradually decreasing in amount, with a return of the natural elasticity;* the alteration of sound is long, however, in being perfectly removed.

Auscultation. *Respiratory murmurs weak and harsh; redux crepitant*, or *sub-crepitant rhonchus* [§ 97.]; *still some bronchophony, gradually disappearing.*

b. *Lobular Pneumonia.*

[The pneumonia of infancy, and in a particular form that preceding the formation of secondary abscesses in the lungs from the circulation of pus with the blood.]

Inspection, Application of the Hand, Mensuration, and Percussion [§ 215.] give merely negative results in true lobular pneumonia.

Auscultation. Respiration exaggerated in some points; harsh, bronchial, or *even slightly blowing sometimes in others;* occasionally a *few cracklings of an imperfect crepitant rhonchus;* in children, the dry or humid rhonchi of bronchitis.

Chronic Consolidation of the Lung.

Chronic Pneumonia.

Inspection. Depression, especially visible in the infra-clavicular region; *diminished freedom of costal movements, while the general motions are not perceptibly affected.*

Application of the hand. Increased vocal and tussive vibration.

Mensuration. Antero-posterior diameter in the infra-clavicular region diminished; semicircular measurement of the side sometimes diminished.

Percussion. Sound diminished in clearness and duration, resistance increased; tendency to the wooden or to the tubular character sometimes manifested.

Auscultation. Respiratory murmurs weak in the affected spot, harsh, bronchial, or *having the diffused blowing character to a slight amount; exaggerated in the neighbouring parts; bronchophony; bronchial cough; heart's sounds transmitted with undue intensity; irregular subcrepitant rhonchus in small quantity, occasionally, at the very earliest period of the lapse of the disease into the chronic state.* [§ 216.]

Pulmonary Abscess.

[In diagnosticating pulmonary abscess, the first point to be ascertained is whether the signs of pneumonia have existed in the organ which is suspected to be the seat of purulent collection. Admitting this to be settled in the affirmative, the special signs of abscess will vary according as the pus has been more or less completely evacuated, or is still retained.]

a. *Pulmonary Abscess of which the Contents are more or less completely evacuated.*

The diagnosis is grounded generally on the fact of the signs of excavation supervening upon those of pneumonia. [§ 226.]

Percussion. Sound dull, duration short; resistance of walls marked; the note has the tubular, amphoric, or the cracked-metal character in some cases. [§ 227.]

Auscultation. Cavernous respiration, or *blowing of the tubular variety* (very rarely am-

phoric); *large mucous*, with *metallic character, cavernulous or cavernous rhonchus; pectoriloquy*, or very rarely amphoric resonance; *cavernous cough.*

b. *Pulmonary Abscess of which the Contents are retained.* [§ 228.]

The signs supervening on those of pneumonia are here necessarily obscure.

Percussion. *The pre-existing dulness of sound becomes more marked in a limited space; the note may acquire the tubular* character. [§ 229.]

Auscultation. *Respiration of the tubular variety of the blowing type intensely marked; strong bronchophony and bronchial cough.*

SPHACELUS OF THE LUNG.

The signs of sub-acute inflammation or of general congestion, followed by those of a cavity, with peculiar fœtor of the breath and expectoration. [§ 230.]

PULMONARY ŒDEMA.

Inspection. No sign sufficiently marked to be of consequence.

Application of the hand. Vocal vibration slightly increased.

Percussion. *Clearness and duration of sound decreased, and resistance of walls increased:* these changes are generally moderate in degree.

Auscultation. *Respiration of persistent weak type, mingled with liquid variety of subcrepitant rhonchus; slight bronchophony in marked cases.*

Pulmonary Apoplexy.

Inspection. General motions somewhat impeded, if the effusion of blood be very considerable.

Application of the hand. Vocal vibration somewhat increased under the same circumstances.

Percussion. *Clearness and duration of sound diminished, resistance of walls increased in proportion to the accumulation in the lung.*

Auscultation. *Respiration of persistent weak type directly opposite effusion; if the effusion be extensive, the murmurs may be suppressed within a very limited space; beyond the limits of the effusion, respiration exaggerated and harsh, bronchial or even slightly blowing; liquid variety of subcrepitant rhonchus mingled with larger humid* (mucous) *rhonchus,* if *hæmoptysis be present; slight bronchophony.*

Chronic Phthisis.

a. *Stage of Tuberculous Consolidation.*

Inspection. Bulging of infra-clavicular region at the very earliest period of deposition? [§ 124.]; *somewhat later, commencing de-*

pression or flattening of this region; diminished freedom of costal motions in the part corresponding to the tuberculous accumulation, and hence alteration in the natural proportion of these to the general motions. [§ 135.]

Application of the hand. Vocal and tussive vibration slightly increased at first, more so with the advance of consolidation; deficient movement of the infra-clavicular region, depending on the comparative immobility of the ribs.

Mensuration. Diminution of antero-posterior diameter in infra-clavicular region,—if notable at this period, pleural false membrane is probably present in some quantity. [§ 19.]

Percussion. Sound diminished in clearness and in duration, and resistance increased in the clavicular, infra-clavicular, and supra-scapular regions; the diminished clearness gradually passes into a state of complete dulness; special character of sound, wooden under particular circumstances. [§ 40.] If the consolidation be slight, and in scattered points, the increase of clearness produced by a full inspiration will be, in comparison with that on the healthy side, very trifling; and on the other hand there will be comparatively a great diminution of clearness at the close of a complete expiration. [§ 143.]

Auscultation. Respiratory murmurs in the infra-clavicular region, and also usually in the upper scapular, weak, and almost suppressed in some points, exaggerated in others; or

harsh, bronchial, or even slightly blowing, with the expiratory murmur particularly marked both in duration and intensity [§ 76.] ; *rhythm of murmurs often jerking* [§ 152.] ; *dry crackling rhonchus, gradually passing at the close of this stage into the humid crackling* [§ 163, 164. 170.] ; occasional friction sound of the grazing variety in different parts of the chest (rare) [§ 178.]; *bronchophony and bronchial cough of gradually increasing intensity; heart's sounds audible, with unnatural clearness;* subclavian murmur. [§ 203.]

b. *Stage of Softening.*

Inspection. *Depression or flattening increased, more or less obvious now in the infra-clavicular, post-clavicular, and supra-scapular regions;* clavicle sometimes twisted on its long axis downwards and inwards, which has a tendency to conceal infra-clavicular depression [§ 5.]; *motions of ribs further impeded.*

Application of the hand. Vocal and tussive vibration increased; deficient movement of the infra-clavicular region more marked than before.

Mensuration. *Semicircular measurement decreased* (in consequence of the general deposition of tuberculous matter, atrophy and interstitial contraction of the lung, together with, in some cases, contraction of pleural false

membrane); *defective expansion of the chest in inspiration; diminution of antero-posterior diameter at apex; diminution of transverse diameter, especially opposite upper part of axillary regions.*

Percussion. Sound completely dull and of short duration; resistance extremely marked; wooden character of sound now common.

Auscultation. Respiratory murmurs masked in the site of softening by abundant humid crackling, subcrepitant (very rarely by true crepitant [§ 169.]), *mucous of thin metallic character or cavernulous rhonchus; in the parts adjoining, respiratory murmurs of the diffused blowing type, and intermixed sometimes with the rhonchi;* rubbing or even creaking variety of friction sound, audible at the apex before and behind [§ 104.]; *in lower parts of the lung the respiratory sounds are as described in the first stage. Strong, concentrated bronchophony, nearly allied to pectoriloquy; bronchial cough; heart's sounds transmitted as before.*

Situation of surrounding parts. Heart elevated above its natural position, as also the corresponding divisions of the diaphragm and the subjacent abdominal viscera.

c. *Stage of Excavation of the Lung.*

Inspection. Signs the same as during the second stage; some of them may now be increased in degree.

Application of the hand. In addition to the signs of the second stage, rhonchal fluctuation may be present [§ 139.]; and, if there be a cavity of very large size, fluctuation, produced by succussion of the trunk, may be felt.

Mensuration. Signs the same as during the second stage.

Percussion. Sound completely dull and of short duration, resistance extreme, conjoined commonly with more or less of the wooden special character; or, under particular conditions of the excavation, sound unnaturally clear and prolonged, the resistance being at the same time marked [§ 21. 32. 142.]; *the special character of the sound in the latter case is almost always tubular, amphoric, or cracked-metal like.* [§ 43.]

Auscultation. Respiration cavernous or amphoric, alternating with rhonchi; gurgling (or rarely dry) *cavernous rhonchus; pectoriloquy, strong concentrated bronchophony or amphoric resonance; cavernous or amphoric cough; metallic tinkling or echo, accompanying respiration, voice, or cough* (rare) [§ 198.]; *clicking sound produced by movement of contents of the cavity by the heart's action.*

Succussion. Sound of thoracic fluctuation, if there be a cavity of very large size. (Rare.)

Situation of surrounding parts. Same as in the second stage.

Acute Phthisis. [§ 225.]

a. *Non-suppurative, Asphyxiating Variety.*

Inspection. No morbid condition of any importance.

Application of the hand. Vocal vibration somewhat increased.

Percussion. *Sound decreased in respect of clearness* and duration, *with proportionate increase of resistance of walls; this state may be limited to some points, and in others natural sonorousness exist; the diminution of sound becomes more and more marked and general, but does not lapse into complete dulness.*

Auscultation. *Respiration weak in some points, exaggerated, harsh, and slightly bronchial in others; dry bronchial (sonorous, and sibilant), or subcrepitant and mucous rhonchi; bronchophony, if the miliary tubercles be especially congregated towards any particular spot.*

b. *Suppurative Variety.*

The signs of bronchitis, as in the non-suppurative variety.

Upon these supervene *dulness of sound under percussion*, which may become *entirely marked.* Mucous rhonchus with large bubbles, passing into the cavernulous, with metallic character; bronchophony.

CANCER OF THE LUNG, MEDIASTINUM, OR PLEURA. [§ 232.]

a. *Infiltrated cancer of the lung; alone, or combined with tuberous cancer, but not to such extent as to cause dilatation of the side.* [§ 233.]

Inspection. *Retraction of the affected side; diminished motions of expansion and of elevation; diminished costal motions;* intercostal spaces deeper than natural.

Application of the hand. *Vocal and tussive vibration diminished in intensity.*

Mensuration. *Semicircular measurement diminished;* deficient increase of width during inspiration.

Percussion. *Sound intensely dull,* and of short duration; *resistance of walls marked;* special character of sound tubular in some cases about the edges of the infra-clavicular and also the mammary regions; the *limits of the dull sound natural beyond the middle line in some cases.*

(*Before softening of the Cancerous Matter.*)

Auscultation. *Respiration of diffused blowing type strongly masked, or with progress of disease* (which leads to obstruction or obliteration of the bronchi) *weak or almost suppressed,* retaining as long as it exists its blowing or bronchial character; *respiration exaggerated on healthy side; bronchophony; bronchial cough; heart's sounds transmitted with increased intensity.*

(*After softening of the Cancerous Matter.*) [§ 234.]

Percussion. *Sound may become somewhat clearer, and the resistance of the walls diminish.*

Auscultation. *Cavernous respiration; mucous, cavernulous, or cavernous rhonchus.*

Situation of surrounding parts. *Mediastinum,* more rarely the heart, *detruded to the opposite side; corresponding division of the diaphragm, with its subjacent viscera, may be depressed.* [§ 235.]

b. *Tuberous Cancer of the Lung or Pleura, with Dilatation of the Side.* [§ 236.]

Inspection. *Affected side expanded, or affected with bulging inferiorly; intercostal spaces widened, flat or even convex; motions, both general and costal, abolished* completely; *fluctuation never visible in intercostal spaces.*

Application of the hand. *Surface unnaturally smooth and even; vocal and tussive vibration abolished; neither simple fluctuation* nor peripheric fluctuation? [§ 236.] *to be detected; pulsatile vibration sometimes present.*

Mensuration. *Increase of semicircular measurement of the* side; width of side unaltered by inspiration; *antero-posterior diameter increased; vertical measurement increased;* distance between the nipple and the median line greater than on the opposite side.

Percussion. *Sound completely, and most exten-*

sively dull, and of short duration; *resistance of walls extreme; limits of the dull sound not altered by changing the posture of the patient.*

Auscultation. Respiration of the diffused or tubular blowing type, intensely developed in some cases; rhonchi either absent or those of coexisting bronchitis; bronchophony, sometimes so intense as to amount almost to pectoriloquy; bronchial cough; heart's sounds transmitted with unnatural intensity; double additional pulsation with blowing murmurs sometimes heard also; exaggerated respiration on the healthy side.

Situation of surrounding parts. Heart and mediastinum detruded to the opposite side; corresponding division of the diaphragm, with its subjacent viscera, depressed, sometimes to a very great amount.

Pleurisy.

a. *Dry Period.* [§ 224.]

Inspection. Diminished motions of expansion and elevation [§ 133.]; *jerking rhythm of these motions;* partial motions also slightly lessened in amount.

Percussion. Clearness of sound not perceptibly diminished.

Auscultation. Intermittent weak respiration; occasionally, but rarely, grazing variety of friction sound. [§ 177.]

b. *Period of Plastic Exudation.*

Inspection. *Signs the same as during the dry period.*

Application of the hand. *Rubbing vibration occasionally to be felt.*

Percussion. *Clearness and duration of sound somewhat diminished;* if notably so, and the sensation of resistance very slightly but distinctly increased, the plastic matter is abundant; *deep respiration will restore, in a great degree, the natural clearness of sound.*

Auscultation. *Intermittent weak respiration; rubbing or even grating variety of friction sound.* [§ 175.]

c. *Period of Effusion.* [§ 217.]

c. 1. *Of Laminar Effusion.*

Inspection. *Signs usually as in the previous periods,* but *sometimes the partial and general motions become freer, and cease to be jerking in consequence of decrease of pain.*

Application of the hand. *Diminution of vocal and tussive vibration; rubbing vibration, if before perceptible, ceases to be felt.*

Percussion. *Sound diminished in clearness and in duration; sense of resistance increased: these changes exist to an equal amount all over the chest, and are not influenced by any change of posture of the patient.*

Auscultation. *Deep-seated persistent weak respiration,* with harsh or slight bronchial cha-

racter; *friction sound ceases commonly to be audible; vocal resonance louder than natural, and generally having some ægophonic character,* — this *unnatural resonance being diffused, though commonly most marked towards the angle of the scapula.*

c. 2. *Of Gravitating Effusion.*

Inspection. Motions of expansion and elevation, and costal motions much diminished, especially at the lower parts of the chest.

Application of the hand. Vocal and tussive vibration abolished at the inferior parts of the chest; rubbing vibration not perceptible.

Mensuration. Defective expansion of the chest in inspiration.

Percussion. The upper part of the chest is found to have recovered in some degree its natural sound; the sound of the lower is completely dull and proportionally short, the sense of resistance here extremely marked [§ 218.]; *the limits of the dull and clearer-sounding parts are distinguished by a tolerably well-defined line; the limits of the dull sound commonly change with the position of the patient;* deep inspiration has no influence on the limits or degree of the dull sound.

Auscultation. Respiratory murmurs suppressed where effusion most abundant, weak where less so; in some comparatively rare cases, however, the *respiration is distinctly audible, and of the diffused blowing type in the*

parts directly corresponding to the effusion [§ 219.]; *above the effusion they are exaggerated, harsh, or bronchial; friction sound almost always inaudible, sometimes, however, may be slightly detected towards the upper edge of the effusion, where also ægophony* is heard, especially towards the angle of the scapula [§ § 191, 192.]; *ægophony may be absent or replaced by bronchophony.* [§ 190.]

c. 3. *Effusion with Dilatation and Detrusion.*

Inspection. *Affected side expanded, intercostal spaces widened, flat, or even convex; motions of expansion almost completely abolished;* lower part of chest slowly dragged upwards, a motion which seems to take place later than on the other side; *costal motions abolished;* fluctuation visible in rare cases of considerable bulging of the intercostal spaces.

Application of the hand. Surface felt to be unnaturally smooth and even; *vocal and tussive vibration not to be detected;* simple fluctuation producible in cases of bulging of the intercostal spaces; peripheric fluctuation.

Mensuration. *Increase of semicircular measurement of the side; deficient enlargement of side during inspiration; antero-posterior diameter increased; vertical measurement also increased;* distance between the nipple

and the median line greater than on the opposite side.

Percussion. *Sound completely dull, and of short duration where the fluid exists; resistance extremely marked;* the limits of the dull sound not altered by changing the position of the patient.

Auscultation. *Respiratory murmurs totally suppressed except close to the spine and under the clavicle, here harsh, bronchial, or even slightly blowing, sometimes more extensively audible of the latter type* [§ 219.]; friction sound inaudible [§ 179.]; ægophony or other vocal resonance ceases commonly to be perceptible. [§ 220.]

Situation of surrounding parts. *Heart and mediastinum detruded to the opposite side; the corresponding division of the diaphragm depressed with the subjacent abdominal viscera.*

d. *Period of Absorption.*

d. 1. *Without Retraction of the Chest.*

Inspection. The *appearances of enlargement and bulging gradually disappear, and with them the obstructed state of the general and partial motions;* fluctuation ceases to be visible.

Application of the hand. *Natural intercostal depressions again felt,* increased by emaciation; rubbing vibration sometimes reappears, as also *vocal and tussive vibration.*

Mensuration. The *semicircular and vertical mea-*

surements fall to the natural standard; the distance between the nipple and median line decreases gradually to the natural amount.

Percussion. Sound gradually recovers its natural clearness and duration, first at the upper then at the lower parts, at the latter it may long retain some degree of dulness; the sensation of resistance alters in the same way; the clearness of sound may sometimes be increased by a full inspiration.

Auscultation. Respiratory murmurs gradually restored, but remain for a variable time weak and slightly harsh; friction sounds sometimes reappear and continue audible for an indefinite period; ægophony or bronchophony (redux) reappear.

Situation of surrounding parts. Heart, mediastinum, vault of the diaphragm, and subjacent abdominal viscera, restored to their natural position.

d. 2. *With Retraction of the Chest.*

Inspection. Retraction, or more commonly *depression* [§ 126.]; *procidentia of the shoulder, of the ribs, and of the nipple;* in rare exceptional cases elevation of the shoulder [§ 129.]; *scapula tilted outwards at its inferior angle;* lateral curvature of the dorsal spine, with the concavity towards the diseased side; *distortion of the ribs* [§ 131.]; *intercostal spaces unnaturally narrow; diminished motions of expansion and of elevation, especially of the former, while the latter is effected in the*

same manner as during the period of effusion with dilatation; motions of ribs on each other much impaired.

Application of the hand. Surface felt to be irregular and uneven; rubbing vibration sometimes, but rarely, felt.

Mensuration. Semicircular measurement diminished; deficient increase of width during inspiration; *antero-posterior diameter diminished;* as likewise the vertical measurement; *distance between the nipple and the middle line diminished* [§ 222.]; distance between the clavicle and the nipple increased [§ 20.]; that between the nipple and the iliac spine, and between the nipple and the twelfth rib, decreased. [§ 222.]

Percussion. Sound dull and of short duration with marked resistance under the finger at the lower parts; superiorly it is clearer, in the inferior regions it has a wooden character, and at the antero-superior often a tubular one. [§ 41.]

Auscultation. Respiratory murmurs suppressed at base, at upper parts weak and harsh, or bronchial; this partial restoration may not occur for many months after the commencement of contraction; *friction sounds commonly audible, of rubbing, grating, or creaking type; bronchophony and bronchial cough, especially posteriorly.*

Situation of surrounding parts. The vault of the diaphragm and the subjacent viscera are sometimes drawn above their natural level;

mediastinum and heart commonly, but by no means always, restored to their natural positions. [§ 221.]

PNEUMOTHORAX.

Inspection. Motions, both general and partial, lessened in amount; side expanded; intercostal spaces widened.

Application of the hand. Diminished vocal and tussive vibration.

Mensuration. Semicircular measurement increased in cases of great accumulation; deficient increase of measurement of side during inspiration.

Percussion. Sound increased in clearness and duration, resistance of walls decreased; special character of sound tympanitic; comparatively deficient diminution of clearness at the close of full expiration.

Auscultation. Deep-seated, persistent, weak respiration, if the accumulation be moderate; respiratory murmurs suppressed, if considerable; vocal resonance weak in the former case, suppressed in the latter [§ 188.]; metallic tinkling accompanying voice and cough (imperfect and rare) [§ 200.]; intensity of heart's sounds on affected side diminished.

Situation of surrounding parts. Heart and mediastinum detruded to the opposite side; corresponding half of the diaphragm and

subjacent viscera detruded downwards: these displacements occur only where the quantity of air is very considerable.

HYDRO-PNEUMOTHORAX.

a. *Simple.* [§ 41.]

A combination of the signs of pleuritic effusion and of pneumothorax; the former at the lower, the latter at the upper part of the affected side.

b. *Fistulous*, or *by perforation.*

Inspection. *Side expanded; intercostal spaces widened; motions, both general and partial, lessened in amount.*

Application of the hand. Diminished vocal and tussive vibration; fluctuation felt on performing succussion of the chest.

Mensuration. Semi-circular measurement of the affected side increased; deficient increase of width of side during inspiration.

Percussion. *Clearness and duration of sound diminished, and resistance of walls increased at the lower parts; clearness and duration of sound increased, and resistance of walls diminished at the upper; special character tympanitic superiorly; limits of clear and dull-sounding parts changeable with the posture of the patient.*

Auscultation. *Respiration amphoric; resonance of voice and of cough amphoric; respiration accompanied by metallic tinkling or echo.*

Succussion. Sound of thoracic fluctuation. [§ 223.]
Situation of surrounding parts. The same displacements may exist as in pneumothorax.

PLEURODYNIA. [§ 224.]

Inspection. Movements of expansion and of elevation diminished, as also the partial motions; jerking rhythm of the general motions.
Percussion. Clearness of sound not perceptibly altered.
Auscultation. Respiratory murmurs of intermittent weak type and jerking rhythm.

LARYNGITIS.

Laryngeal Signs.

Auscultation. Harsh laryngeal respiration; sonorous or sibilant laryngeal rhonchus, where obstruction exists to any amount; valvular laryngeal rhonchus; if ulceration with secretion on surface, *gurgling laryngeal rhonchus.*

Pulmonary Signs.

The great majority of cases of chronic laryngitis (I have never seen an exception to this) are tuberculous; the lungs therefore furnish the signs of tubercle more or less advanced. When there is much obstruction in the larynx, the signs derived from respiration may be extremely obscure on account of the small quantity of air which reaches the

bronchi; in such cases the signs derived from percussion, inspection, application of the hand, and measurement of the antero-posterior diameter in the infra-clavicular regions, will leave no doubt as to the state of the subjacent lung.

Croup.

Laryngeal Signs.

Auscultation. *Harsh laryngeal respiration; sonorous laryngeal rhonchus, frequently with a metallic character* [§ 108.]; flapping laryngeal rhonchus (where false membrane hangs loosely in the passages). [§ 186.]

Pulmonary Signs.

Those of bronchitis or of pneumonia; or these signs may be absent, either because the affections named do not exist, or because the laryngeal obstruction interferes both with the production of the respiratory murmurs and of all morbid auscultatory signs. The pulmonary sounds may also be masked in a great measure by the loud laryngeal rhonchus.

PART III.

COMMENTARY.

[The figures marked thus, §, denote the number of each paragraph in the Commentary; those included within parentheses, the page of the text to which each paragraph refers.]

§ 1. (1.) It must be admitted that, in the present state of knowledge, there are a few diseases in which no anatomical change can be discovered after death; still, as I have elsewhere said, it appears to me a question whether advancing science will not, by and by, demonstrate their organic nature. *A priori* reasoning, but, better still, previous experience, serves to show that, in all probability, the existence of purely functional or dynamic diseases is more imaginary than real.

§ 2. (2.) Besides those mentioned in the text, some other methods of physical investigation have been from time to time proposed: they will require very brief mention only.

Abdominal pressure from below upwards, in the hypochondrium of the affected side, recommended by Bichat as a means of ascertaining the degree of permeability of the lung by means of the dyspnœa and distress it produced, is now recognised to be valueless as a means of diagnosis. Pressure of the *sound* side, by interfering with the expansion of the corresponding lung, occasionally increases the existing difficulty of breathing, as observed by

Rullier, Chomel, and Townshend; but the sign is one of very secondary value and importance. See, also, Laennec, translated by Forbes, Amer. edit. p. 17.

Under the name of *Acouophonia* or *Cophonia*, M. Donné has described a mode of investigation in which the observer places his ear to the chest and analyses the sounds produced by percussion of the surface. The experience of M. Fournet and of others has shown that the perceived sound bears no precise relation to the condensation or rarefaction of the subjacent parts; the method is, therefore, obviously worse than worthless.

The merit of prior observation has been claimed by M. Taupin in respect of a process to which the title of *Autophonia* has been given by M. Hourmann. It consists in noting the character of the observer's own voice, while he speaks with his head placed closely to the patient's chest; the voice will, it is alleged, be modified by the condition of the subjacent organs. That the observer's voice acquires an ægophonic character in cases of pleuritic effusion, I have myself observed; but I doubt the certainty of the sign. The only circumstances under which it could be really useful would be in the examination of infants, as suggested, I believe, by M. Hourmann himself.

§ 3. (5.) Although inspection and mensuration of the chest have been more or less practised since the time of Laennec, it must be confessed that until the appearance of M. Woillez's recent work (*Rech. Prat. sur l'Inspection et la Mensuration de la Poitrine;* Paris, 1838: see also *Brit. and For.*

Med. Rev. vol. vii. April, 1839), observers had no very extended or precise views of the information obtainable by their means. The prolixity of the volume will unfortunately deter many from giving it the perusal to which its numerous important facts strongly entitle it; but it is impossible to take it up, and more especially to test at the bed-side the value of the information it contains, without a feeling of surprise that the importance of these methods of investigation should so entirely have escaped the acute perception of Laennec. While disposed, however, to give M. Woillez all the praise due to the first *systematic* employer and describer of inspection and mensuration, I must observe that many of the practical diagnostic indications in his work had already been made familiar to the physician by Sir James Clark, M. Louis, Dr. Stokes, and others. *Vide* § 6.

The student will, possibly, consider the details I have thought it right to enter into on this part of the subject minute and troublesome; it is merely because he is less familiar with them than those referring to auscultation and percussion, and a very little practice will convince him of their simplicity and real importance.

§ 4. (5.) In the classical volume of Dr. Stokes (*On Diseases of the Chest*, p. 24.) the value of comparison is most admirably illustrated and explained.

§ 5. (6.) M. Fournet remarks, that if a piece of tape be stretched between the nipple and the most prominent part of the clavicle in individuals of ordinary stoutness, and having a well-formed chest, the tape and skin will be in contact, except immediately

underneath the clavicle; while, in certain states of disease, for example, phthisis, the case is very different, a considerable interval being observable.

This is, however, I have repeatedly found, a very fallacious mode of judging of the natural or altered volume of the upper part of the lungs. On the one hand, there is *sometimes* no remarkable interval of the kind described to be detected in chests of which either infra-clavicular region is proved by the callipers to have undergone considerable depression, and this because the *clavicle itself has been carried downwards and backwards in the direction of the centre of the lung*, at the same time and by the same process as the flattening of the thoracic surface has been accomplished. This change of position of the clavicle, which seems to imply a twisting of the bone at its articulations, is a point both curious and important, though not noticed by any writer on the diagnosis of phthisis: it explains why admeasurement with the callipers is the only *perfectly* satisfactory method of ascertaining whether the summit of the chest has or has not undergone collapse. On the other hand, the clavicle is so unusually prominent in some subjects (perfectly free from pulmonary disease) that M. Fournet's experiment discovers an interval between the tape and skin, which, according to his doctrine, would announce a most remarkable degree of collapse.

§ 6. (7.) The most remarkable general fact, of which the discovery is due to M. Woillez, appears undoubtedly in the very great rarity of a perfectly regular and symmetrical form of the thorax even in subjects who have never suffered from any pectoral

disease. From the inquiries of this very laborious observer, it follows that a *regularly* formed chest (as described in the text) exists in scarcely more than one of every five persons taken indiscriminately (41 out of 197 cases). The partial deformities or heteromorphisms *, which deprive the chest of *regularity* of proportion, while they are perfectly compatible with health, are, on this latter account, termed *physiological;* the name *pathological* being applied to those that are the manifest results of disease.

Regularly formed chests are more common among persons aged from 15 to 30, or who follow sedentary pursuits or trades requiring little muscular exertion, or who have never laboured under thoracic disease, than among other individuals. The previous occurrence of chest affection does not, of course, necessarily imply the existence of heteromorphism.

It is obvious that the chief, almost the sole, clinical importance attached to these "physiological" departures from regular form consists in the chance of their being confounded with, or mistaken for, alterations of shape dependent on disease. Their frequency indicates the necessity of being acquainted with them: in 197 cases there existed 251 examples of *natural* heteromorphism; 144 of these occurring in 111 subjects who had had thoracic disease, 107 in 86 individuals who had all their lives been perfectly free from such disease. (Woillez, p. 358.)

§ 7. (7.21.) In stating simply that the *narrow* part

* The definition of the term heteromorphism, and its relation to displacements in general, are explained in the article "Ectopia" in the *Cyclopædia of Surgery.*

of the cone represented by the chest is *uppermost*, I have been as precise, in regard of the proportional dimensions of the upper and lower parts of the chest, as my own experience and that of others permits. The number of comparisons which I have made between the circular dimensions of the chest, on the level of the infra-clavicular and lower part of the mammary sub-regions, although limited, justifies me in doubting that any ratio between the two measurements, sufficiently constant to be trusted to in practice, exists. The observations of M. Fournet appear to have led him to form a similar opinion. He infers from them also that the size of the upper part, compared with the base, is greater in proportion as the muscular and osseous systems, especially the latter, are strongly developed, and the constitution of the individual free from the taint of predisposition to phthisis.

§ 8. (8.) The following is the result of M. Woillez's examinations, from which it appears that it is more common to find chests presenting general prominence of the right side posteriorly or of the left side anteriorly, than a perfectly regular shape.

	No. of Cases
1. General prominence of the right side of the back -	58
2. General left anterior prominence - - -	52
3. *Regular conformation of the chest* - - -	41
4. Sternal prominence - - - -	30
5. Sternal depression - - - -	22
6. Transverse narrowness of the chest - - -	17
7. Dorso-vertebral deviation - - - -	16
8. Double prominence of anterior part of second ribs -	12
9. General prominence of left back - - -	10
10. Lowered position of left nipple - - -	8
11. Partial prominences of right back - - -	7
12 Anterior prominence of either second rib - -	4

		No. of Cases
13.	Prominence of cartilaginous border of left ribs	3
14.	Partial prominence of left back	2
15.	Symmetrical prominence of both sides anteriorly	2
16.	Anterior right prominence	2
17.	Lateral deviation of sternum	1
18.	Prominence of the sternal extremity of the cartilages of the left true ribs	1
19.	Double symmetrical prominence of nipples	1
20.	Double symmetrical depression of the submammary region	1
21.	Non-symmetrical position of shoulders	1
22.	External arching of right side	1

In 72 out of 135 subjects there was only one heteromorphism; in the remaining 63 two, three, four, and even five appeared in the same individual.

It is obvious that a full description of these different modifications of shape would be altogether out of place in a work of the present kind.

§ 9. (9.) A solitary exception to the statement in the text is furnished by the anterior prominence of the left side, caused by undue thickness of the soft parts; as might be anticipated from the nature of the prominence, the sound under percussion is somewhat duller than on the other side. (Woillez, 358.)

§ 10. (9.) Of 63 individuals who had never suffered from chest disease, *one* only was the subject of *general* heteromorphism; the antero-posterior diameter of the thorax was in this case unduly developed in respect of the transverse: there were some *local* defects of form also present. (Woillez, p. 92.)

§ 11. (9.) The annexed table of the three kinds of heteromorphism is offered rather as a guide to the student in the prosecution of enquiries on this

subject, than as a perfect statement: further experience will no doubt make some changes necessary.

Heteromorphisms.

Either Non Pathological or Pathological.	Non-Pathological only.	Pathological only.
Procidentia of the left nipple. General bulging of left side anteriorly. Bulging of left sterno mammary regions. Lateral deviation of the spine.	Bulging of the infra-scapular regions, if limited to them posteriorly. Sternal depression. Prominence of right side posteriorly. Prominence of left side anteriorly. Sternal prominence: and others given in § 8.	Marked depression of infra-clavicular region. Infra-clavicular bulging. Procidentia of the right nipple. Antero-lateral depression. Considerable diminution of circumference superiorly as compared with inferiorly. Sterno-mammary prominence of left or right side. General anterior prominence of left side. Prominence of post-clavicular region. *Except in the rarest instances, pathological.* General diminution of transverse diameter of chest; producing, as it increases, the cylindrical form.

§ 12. (9.) Yet, as is well known, mensuration proves the reality of an excess in the dimensions of the right side (see text, p. 21.),—one among other evidences of Laennec's error in maintaining that difference in bulk of the two sides was more readily *seen* than ascertained by mensuration.

Dr. Williams (ed. 4. p. 5.) states that the superiority on the right side is frequently perceptible to the eye at the lower part of the chest, especially behind. There is certainly a prominence of this part of the thorax as a natural condition in a very large proportion of subjects (in upwards of one third of them; Woillez); but that it is not this prominence which causes the excess in measured dimensions, appears from the fact that similar prominence of the

left side anteriorly is within a small fraction as frequent a non-pathological appearance.

§ 13. (10.) When respiration is diaphragmatic rather than costal, the lower part of the thorax may be seen, and still better felt, to *contract* during inspiration.

The estimate given in the text of the proportional duration of the movements of inspiration and expiration is understood to refer to calm respiration, and the point is one so exceedingly difficult to determine that it must be considered simply approximative.

§ 14. (11.) I would beg to refer the reader to the article "Ectopia" in the *Cyclopædia of Practical Surgery*, for the precise nosological history of the changes of form and position mentioned in the text, as well as for fuller details upon their anatomical characters. I venture to do this, because the nature and relations of various kinds of displacements have hitherto been so imperfectly fixed that the reader might, without such reference, possibly misconceive the sense in which I have employed the terms in the text.

§ 15. (16.) There is no point connected with physical diagnosis respecting which, judging from the conflicting statements of authors, so much uncertainty and doubt prevail, as the true signification of vocal fremitus and its modifications.

According to Laennec, vocal fremitus is no longer observable "when, through disease, the lungs have ceased to be permeable to the air, or are removed from the wall of the chest by an effused fluid." (*Ed. cit.* p. 12.) He speaks very disparagingly of the

value of the sign. Dr. Williams (*loc. cit.* pp. 36. 110.) adopts, though somewhat dubitatively, the views originally promulgated by M. Reynaud (*Thèses de Paris*, 1819). "Liquid in the pleura," he says, "will *generally more or less* destroy the thoracic fremitus. . . . Consolidation of the lung, again, will increase the vibrations, or make them even stronger, over the bronchial tubes. In cases where one side is quite dull on percussion, we may *often* thus *easily distinguish* whether the dulness is caused by consolidated lung or liquid in the pleura." Dr. Stokes, who ascribes the discovery of the sign in this country to Dr. Hudson, considers it "of far greater value" as a means of diagnosis in pleuritic effusion than ægophony. "We can detect," he says, "a pleuritic effusion by the absence of vibration over the dull portion. It is an exceedingly useful sign, and assists much in the diagnosis of pleural effusion, hepatization, and enlargement of the liver. In the second case, however, I have found, although bronchophony existed over the dull portion, yet that the vibration perceived by the hand was less distinct than on the healthy side. Hepatization of the lung seems to *diminish* but *not remove* this vibration." In respect of the natural conditions of the fremitus, Dr. Stokes observes that in most healthy chests it will be found, like vocal resonance, stronger on the right than the left side. "In a few, however, the vibrations are equal; and I have observed some cases in which there was the greatest resonance on the side where there occurred least vibration as perceived by the hand." (*Op. cit.* p. 497.)

M. Hourmann (*Revue Médicale*, t. ii. p. 137. 1838) maintains that even in young children an increase of fremitus on the surface corresponding to hepatized lung will be detected. M. Grisolle found in ten cases of hepatization in the adult that, 1st, there was no vibration at all on either the diseased or healthy side; or, *if there were any*, it was equal upon both, in eight of the ten cases: 2d, in the remaining two cases, there appeared to be a slightly greater amount of fremitus opposite the hepatized parts; but as in these instances the disease was on the right side, the excess may have been nothing more than that naturally existing. (*Op. cit.* p. 248.) M. Fournet having submitted the phenomenon to more systematic investigation than his predecessors, holds opinions of his own upon its conditions. Thoracic vibration is, according to him, at its maximum in the natural state of density of the lungs; it diminishes in proportion as any cause increases or lessens the amount of that density, and therefore is not regulated by the same laws as vocal resonance. Thus vibration is totally suppressed in pneumonia and in pneumothorax, and proportionally diminished in all cases of less complete consolidation or of imperfect rarefaction. On the other hand, increased intensity of vibration, that is, above the natural standard in any given case, is a physical impossibility. (*Op. cit.* p. 567.)

The contradictory nature of several of these opinions will appear more clearly in the annexed tabular view:—

Natural Vocal Fremitus.

	Increased.	Diminished.	Unaffected.
Laennec, Stokes.		In consolidation and in effusion.	
Beynaud, Williams, Hourmann.	In consolidation.	In effusion.	
Grisolle.			In consolidation (from pneumonia at least).
Fournet.	Impossible in any case.	In all changes of density, whether of increase or decrease.	

I entertain, for my own part, not the slightest doubt that M. Fournet is in error in the principle he attempts to establish respecting non-increase of vibration. I have found in cases of tuberculous disease of the summit a very perceptible excess of fremitus on the affected side, and in pure hepatization the same thing is distinctly to be ascertained. I have given the result of my own observation in the table (p. 90.); but at the same time I cannot help feeling that there is something of importance yet to be discovered respecting this sign, and which may furnish a ready clue to the contradictions in the statements of writers on the subject. It is one in which I have myself but very limited confidence.

§ 16. (20.) M. Woillez recommends each side to be measured separately, as a plan more accurate in its results; while M. Fournet gives a series of most complicated directions for the performance of this very simple process. Celerity is a great object, if it can be attained without sacrifice of accuracy; and

I must confess that while the plan I advise is obviously the quickest possible, I have never had reason to believe that it led to incorrect results.

§ 17. (21.) The mean capacity of the chest was found by M. Woillez to be lowest in persons following trades which require frequent exercise of the upper extremities. This rather unexpected result has been objected to, as being derived from too small a number of cases (the total number of persons of all kinds examined was 133), and may perhaps be considered open to debate, or at least pointing to the necessity of further investigation.

§ 18. (22.) A modification of, or rather addition to, the ordinary callipers, adopted by Dr. Stokes, seems well calculated to ensure the great desideratum of equal pressure wherever the instrument is applied. "Above the graduated arc, and attached by a hinge to the blade of the instrument which receives its fixed end, is a cylindrical brass box of about an inch in length, containing a spiral spring attached to a sliding bar, also passing through an eye in the opposite blade. By means of a screw passing through the latter, the bar can be fixed at any point desired; so that when the instrument is extended the sliding spring acts in keeping the balls [at the free extremities of the arched blades] fixed with an equable force to each side of the chest." (*On Diseases of the Chest*, p. 499.)

§ 19. (23.) There appears to me to be no point more distinctly proved by observation, although questioned by some, than that depression of the infra-clavicular, post-clavicular, and upper scapular regions attends many cases of phthisis. At what

period of the disease, and by what process, is this depression effected? Laennec, who first drew attention to the point, referred the depression to evacuation of the contents of cavities, and to their subsequent contraction and so-called "cicatrisation." Subsequently Dr. Stokes showed that depression might set in at a much earlier period, in fact, "without the formation of any cavity whatever;" and referred it to the atrophy of the pulmonary substance, which attends the progress of tuberculization. More recently still, M. Fournet has fixed yet earlier the possible period of development of depression; namely, before softening has occurred. In such cases he has invariably found that the apex of the lung, besides containing tubercle in abundance, was invested with thick and dense false membrane; and to the contraction of the plastic matter forming this membrane, he ascribes the chief influence in causing depression of the corresponding surface. From his observations it would follow that the amount of depression was always directly as the age and density of the plastic matter; and these latter directly as the quantity of tubercle accumulated in the lung. He admits also that the formation of cavities greatly increases the amount of depression.

I am enabled, from my own experience, to confirm the statement of M. Fournet respecting the period at which depression *may* be visible, and likewise his notions on the importance of false membrane in producing it. Respecting the regular proportions he describes between the false membrane, the tubercle, and the change of shape, I must confess myself unable to speak; and I believe that both atrophy of the lung and contraction of plastic matter

exuded into its substance (to which no one appears to have referred) have their influence in producing the depression. Nevertheless it is true that I have not seen notable depression (exclusive of cases of cavity), unless when there was pleural false membrane in considerable quantity present.

In a conversation upon this subject which I recently had with Dr. Chambers, I learned that he has made the interesting observation that an *enlargement* in the antero-posterior diameter of the summit of the chest (and consequently, I presume, some amount of visible bulging) is discoverable in the early stages of some cases of phthisis: *à priori* considerations argue strongly in support of the accuracy of this observation. Enlarged size of the part implicated must in fact be the *first* result of the morbid accumulations at the apex (both tuberculous and simply plastic); but it is, on similar grounds, fair to suppose that the enlargement must be of very short duration,—a circumstance which would plausibly explain its not having hitherto attracted attention. It seems probable (but upon this point I do not know Dr. Chambers's experience) that acute cases, and those in which emphysema coexists, are those in which it will be most commonly detected.

§ 20. (24.) I have published a remarkable example of this apparent contradiction between the results of inspection and mensuration. In this case, although the left nipple was manifestly lower than the right, the distance between the former and its corresponding sterno-clavicular joint was only $5\frac{1}{2}$ inches, while that between the same points on the right side was $6\frac{1}{4}$ inches. (*Cyclopædia of Surgery*,

art. "Empyema," p. 102.) It is to be supposed that such will usually be the result of mensuration, where the retraction after pleurisy affects more especially the antero-posterior diameter. .

§ 21. (25.) In his introductory observations upon physical diagnosis in general, Laennec makes a passing allusion to the "sense of elasticity perceived" in percussing; but in no instance refers to the diagnostic indications derivable from changes in this elasticity. Piorry and others have availed themselves of them fully, but their importance is not generally appreciated. There are cases of not very rare occurrence, in which erroneous inferences would almost inevitably be drawn from the sound elicited by percussion, were these not corrected by the information derived from the degree of resistance felt by the fingers. Take the case of a cavity seated close to the surface: the unnatural clearness of sound which sometimes distinctly exists over such cavities, quite independently of an amphoric *character* in that sound, might not only lead to an incorrect estimate of the state of the subjacent part, but also to the inference that the lung in reality least affected was the most diseased. The sensation of hardness and firm resistance experienced by the fingers at once discloses the true cause of the unusual clearness. Besides the cases are extremely numerous in which it is satisfactory to have the corroborating evidence furnished by the state of resistance in favour of the inference drawn from the sound. That doubt often exists as to the state of the sound on the two sides, is unquestionable; and in these cases the condition of the subjacent parts may

frequently be settled by taking into consideration the amount of resistance.

To those persons whose sense of touch is more delicate than that of hearing, this source of diagnosis is of especial value.

§ 22. (26.) The terms *dull* and *clear* as applied to the sounds elicited by percussion, although obviously incorrect, are retained in this work; because, in the first place, their practical signification is generally understood; and, in the second, it is extremely difficult, if not actually impossible, to substitute correct scientific expressions for them. They are incorrect; because, 1. Dulness and clearness are not phrases opposed to each other, either in the common signification of the words, or in an acoustic sense. 2. Dulness and clearness are not admitted among the properties of sound by natural philosophers; and hence there is this curious contradiction in the works of those writers on physical diagnosis who preface their volumes with an inquiry into the nature of sound, that no such properties as dulness and clearness are ascribed to it, and yet dull and clear sounds are perpetually spoken of in subsequent descriptions. 3. Dull sound is used as synonymous with "little" sound, or "no" sound. Here again is an error; for there is as intense sound produced by percussing the thigh as the infra-clavicular region. It is not in *intensity* that the difference which impresses the ear consists, but in *duration* and in another or other properties: so long as they both last, one is as intense as the other.

In order to substitute correct terms for those in common use, it is plain that we must first under-

stand upon what physical cause depend the conditions practically known as dulness and clearness. The difference is not one of mere *duration*, though, as is shown in many parts of the text, this property bears a fixed relation to the conditions in question. It is difficult to prove that it depends on *note* (dull sounds being so deficient in musical character), but I strongly suspect that such is the fact.

§ 23. (26.) Difference of duration of the sound arising from percussing bodies of different kinds may be illustrated—if examples of the familiar fact be required—by the prolonged ringing sound produced by striking a gong, and the short abrupt one similarly yielded by a beam of wood. The difference in these two instances is considerably greater than any observable in percussing the human body, but less degrees can readily be conceived: the difference in this respect between the sounds emitted by the thigh and the middle sternal region exemplifies one of those degrees.

§ 24. (27.) In cases where extensive and notable difference between the two sides exists, striking them with the palmar surface of the hand will leave no doubt as to the fact; indeed it will disclose the amount, though not the superficial extent, of the alteration of sound, almost as satisfactorily as the more delicate process of mediate percussion. In cases of hepatization and of pleurisy, where it may be inconvenient to submit the patient to a lengthened examination, this method, therefore, has its utility. Some persons strike the chest lightly with the distal end of the stethoscope; but patients always dislike this, and indeed I have known it productive of serious pain.

§ 25. (28.) These objections are, however, far from unimportant. Direct percussion, even when very skilfully performed, rarely fails to give more or less pain: in the hands of an awkward and inexperienced person it is really almost unbearable, and may, with some colour of justice,—because a more efficacious and less painful method can be employed,—be regarded as a piece of cruelty to the patient. Direct percussion cannot be performed over the intercostal spaces; and when the subject examined is very fat, or the subcutaneous tissues are anasarcous or emphysematous, its results cannot at all be depended upon. Besides, the manual process of immediate percussion is exceedingly difficult of acquirement, and the least inattention to the manner of its performance will scarcely fail of leading to erroneous notions of the state of the chest. Mediate percussion is, I am quite aware, liable to a certain extent to the same objection, so much so as to make its practice much more difficult of attainment than auscultation; but there can be no doubt that the chances of error are with it much less numerous and serious.

§ 26. (28.) The index-finger, on account of the accuracy with which it may be fitted, as it were, to the various depressions on the surface, and on account of the simplicity and absence of parade of the plan, will no doubt always continue the pleximeter in most common use. It has in these points of view an unquestionable superiority over M. Piorry's pleximeter. The india-rubber pleximeter, however, is not open to the same objections: there is nothing pompous in its appearance, and by a little management it may be accurately applied even in the inter-

costal spaces of the thinnest persons. It has, besides, this positive advantage, that it saves the finger of the operator,—no trifling matter, where a very large number of patients are to be examined. And its use implies a saving of pain not only to the operator. but also to the patient; as I ascertained most satisfactorily some years ago by a considerable series of comparative trials. Some individuals bear percussion without murmur in this way, who resolutely refuse to allow it if the finger be used for a pleximeter. The only objection I have ever heard urged against the india-rubber is, that it deadens the sound. This, which would be a valid argument if a single point only of the chest were to be percussed, and a direct inference drawn from the result, has in reality not a particle of force; because inferences are invariably drawn from the *comparison* of different parts.

The great objection to the use of any kind of hammer for striking with is, that the information derived from the sensation of resistance of the parts struck is altogether lost.

§ 27. (29.) My objection to placing the dorsal surface of the pleximeter finger next the skin is not a general one; M. Louis, among others, very frequently percusses in this way, and Dr. Stokes appears to prefer it. It is certainly, in some cases, easier to apply the dorsal than the palmar surface of the finger *uniformly* to the part of the chest under examination; but this advantage has always seemed to me much more than counterbalanced by the difficulty of maintaining the finger when in this position in firm opposition to the surface, and above

all of exercising an equal degree of pressure in different situations.

§ 28. (29.) It must be confessed that some difficulty is often experienced in applying the finger, when it is placed *parallel* to the ribs, close to the surface of the upper part of the chest on the right side. For this reason not a few persons, Sir James Clark among the number, prefer as a general rule applying it at right angles with those bones; others stand *behind* the patient while percussing the upper anterior regions. When the latter plan is followed, it has appeared to me as difficult to fix the finger on the *left* side, as on the *right* when the physician stands in the usual way in front of the patient; the position is besides open to several other obvious objections.

§ 29. (30.) This appears to me to be a practical rule of extreme importance. The pain which beginners cause the patient in many cases, and the uncertainty of the results obtained, in a great degree depend upon ignorance of its value or neglecting to observe it. The awkwardness of striking from the elbow, or even the shoulder, as is often done, is a matter of less moment; though an observant patient will scarcely fail to be impressed unfavourably by it, when he finds himself rather pushed about than percussed.

But the essential advantages of this mode of percussing are the nicety with which the force of the blow may be regulated, and hence made precisely equal in any two places it is the object to compare; and the great comparative ease of keeping the percussing fingers at *the same angle* in striking

repeatedly the same or different spots. I venture to affirm that if this way of manipulating were generally adopted, it would be infinitely less common than it now is to hear a new and different note elicited by each of a number of successive blows upon the same place;—a variation, the mere possibility of which constitutes a serious drawback to the utility of percussion as it is too frequently practised.

§ 30. (31.) This precept is in accordance with the rules of Laennec, but perhaps his motives for laying it down were not perfectly well grounded. I cannot say I have found, as he represents to be the case, that "if the patient be in bed, the mattrass, still more the pillows, and also thick curtains, always render the sound less;" and even admitting the fact to be so, as our object is to obtain comparative and not direct results, it would constitute an objection of but slight importance. The difficulty of placing the patient perfectly level in bed (and if he be not so placed, the sound on either side is extremely liable to be modified), together with the constrained positions the physician is obliged to place himself in in order to get at different parts of the chest, appear to me to constitute more solid objections.

§ 31. (31.) The converse is the case when immediate percussion is employed; for the obvious reason, that a flaccid mass of muscle, in itself scarcely vibratile, must, besides, interfere with the transmission of sound from the subjacent parts.

§ 32. (32.) There are a few exceptions to this natural state of relationship of the clearness of the

sound and the resistance of the parietes; instead of invalidating however, they prove the rule. Thus in the internal division of the clavicular and the sternal regions, the sound is clearer than in others, for example, the infra-clavicular, where the resistance is less. This peculiarity manifestly depends upon the nature of the wall of the thorax in the former situations: being there wholly composed of bone, it cannot give way and rebound under percussion to the amount which the slight density of the subjacent parts would otherwise ensure; while, on the other hand, its composition is favourable to frequency of vibration, and hence to clearness of sound.

§ 33. (33.) Laennec, speaking of the post-clavicular region, says, "Here there is no sound whatever, the soft parts in this place yielding passively to the percussion." Laennec referred to *immediate* percussion, and the fact testifies to the superiority of the *mediate* method: from the former, no evidence can be obtained of change in sound depending on deposition of tubercle in the parts directly corresponding to this region.

§ 34. (35.) This fact has been well noticed by Dr. Forbes in its reference to the diagnosis of tubercles. "The greater sonorousness of the chests of thin than fat persons is one reason," he observes, "why percussion frequently fails to detect the presence of tubercles in the lungs, the increase of sonorousness from the extenuation of the parietes compensating for the augmented dulness of the viscus within." (*Transl. of Laennec, ed. cit.* p. 24.) Dr. Stokes has suggested another mode of explaining

the apparent contradiction of a very clear sound being sometimes yielded in cases where the lungs contain a considerable quantity of disseminated tubercle. "It seems possible," he observes, "that an extremely anæmic state of the body, by diminishing the amount of the circulating fluid, may produce a morbidly clear sound on percussion;" and to the existence of such anæmia in phthisis he would ascribe the peculiarity in question. (*Op. cit.* p. 21.)

§ 35. (35.) Dr. Forbes attributes the marked "sonorousness" of the chest in children to the slight development of their muscles, the absence of fat, and also to "the peculiar relations of the air and lungs at that age."

§ 36. (35.) "The chests of some persons are so loosely put together, and so flaccid," observes Dr. Williams, "that they give but little sound, although the organs within are quite healthy." (*Op. cit.* p. 14.)

§ 37. (35.) The limits given in the text are those laid down by Dr. Williams.

§ 38. (36.) Dr. Forbes has called the attention of observers to the influence of respiration on "the intensity of sound" (*ed. cit.* p. 22.); Dr. Williams more especially to the effect it has in altering the limits of pulmonary sonorousness. The latter writer well observes, that percussion, by ascertaining the amount of extension of the clear pulmonary sounds at each motion of inspiration, gives a key to the state of their action and fulness of expansion, and is hence, in truth, a dynamical as well as a statical test.

§ 39. (37.) A single exception to this general

statement exists. When an individual leans forward, a greater extent of surface of the heart is brought in contact with, or close proximity to the walls, than when he is recumbent; consequently the limits of the pulmonary sound will be somewhat modified in the cardiac region, according as either of these postures is assumed.

§ 40. (38.) It is difficult to describe faithfully the wooden character; but a very few opportunities of observing it will familiarise the student sufficiently with its peculiarities. I am inclined to think, from the experience I have hitherto had on the subject, that when well marked it may be considered almost a conclusive sign of a thick and dense stratum of fibrous substance in the pleura, binding the lung and parietes together. No amount of fluid in the pleural cavity, or of consolidation of the lung itself, seems capable of producing it to a marked amount; but all descriptions of consolidation, when false membrane is present in abundance, produce it more or less.

§ 41. (38.) Dr. Williams has particularly drawn attention to the circumstances under which this modified character may be detected in the sound of percussion. The partial pleurisy in which he has observed it was that "affecting the upper and posterior parts of the lung, the inferior being adherent to the diaphragm and lower parts of the chest." I have myself noticed it in cases of general pleurisy, in the stage of retraction, when the plastic matter during its contraction may be supposed to have altered the relations of the lungs to the walls, and brought the tubular part of the former into

undue proximity to the latter. The production of the sound is facilitated by directing the patient to keep his mouth open.

It is easily conceivable that if the pulmonary tissue between the larger tubes and the anterior wall of the chest be consolidated, the sound of percussion will, in that situation, have the tubular character. Such is the case, as Dr. Williams was also the first to point out, in certain cases of pneumonia. There can be little doubt, I may remark here, that the cases described by Drs. Hudson, Graves, and Stokes, as examples of pneumothorax complicating pneumonia, admit of an easy explanation by Dr. Williams's observation. The sign most dwelt upon by these physicians was a remarkable resonance on percussion; but, as we have just seen, this may be otherwise and very simply accounted for. Besides, the evidence of pneumothorax is in other respects extremely defective (some of the cases of Dr. Hudson were rejected by Dr. Stokes), and there is strong motive for believing that the frequency of simple pneumothorax has been much exaggerated. MM. Louis, Chomel, Barth, Grisolle, and many others, have never observed it; and my own experience agrees with theirs, although I have seen not a very few cases of pneumothorax or hydro-pneumothorax at first confidently pronounced to be simple, in which a perforation was at once detected by insufflating the lung.

§ 42. (38.) The amphoric character may also be imitated by striking the backs of the hands, hollow and closed, against the knee — provided in doing this *no air be driven out from the cavity formed by the hands;* if any escape, a sound of

very different character (the cracked-metal) is imitated. The manner of holding the hands so as to prevent any of the air from being pressed out will easily be discovered in a few trials.

§ 43. (39.) The explanation commonly given of the cracked-metal character (*bruit de pot fêlé* of Laennec), that it results from the dashing together of liquid and air in a large cavity, does not appear tenable. All that seems necessary for the production of the phenomenon is, that a cavity of a large size, with anfractuous walls, and communicating freely and by several orifices with the bronchi, should be made by a heavy and slow blow to disgorge its contained *air;* looseness and flexibility of the corresponding parietes being a condition favourable to its production. If, as I found by experiments made some years ago (*Lancette Française,* 1834), the nose and mouth be tightly closed in a patient furnishing the cracked-metal sound when they are open, that character will at once cease to be producible, though percussion continues to give an amphoric note. The fair interpretation of this fact seems to be, that the sudden rush of air from the cavity outwards produced by the forcible blow upon the yielding parietes in the ordinary open state of the mouth and nose, but completely prevented by their closure (the only condition materially altered in the experiment), is the real cause of the phenomenon. Whether the communication with the external air be interrupted or not, the contents of the cavity may be dashed together by percussion: were the common notion correct, the cracked-metal character ought therefore to be elicited in both cases. The

explanation to which I incline derives support from the conditions of production of the amphoric and cracked-metal sounds by striking the hands, closed so as to form a hollow, against the knee: if they be so closed as to prevent air from being forced from between them by the blow, the amphoric character only is detected,—if air be allowed to escape freely, the character analogous to the cracked metal is superadded; yet here, certainly, there is no *liquid* to take part in its production.

§ 44. (40.) This moveableness of the dull sound is by no means as constant a sign of pleuritic effusion as might, from *à priori* considerations, be expected. The liquid is retained *in situ* in some cases by adhesions, which easily explains the fixedness of the dull sound; in other instances, the explanation cannot be found.

§ 45. (40.) The dynamic signs,—for the greater number of which, and for their theory, physicians are indebted to the ingenious observations of Dr. Williams,—are, generally speaking, difficult to be established, and, under all circumstances, need only be applied to in cases of very delicate diagnosis.

§ 46. (41.) It is unnecessary to allude to the sounds (occasionally very distinctly perceptible) produced by the contraction of the muscles of the walls of the chest, as they have no practical signification. It is well for the student to be aware, however, that a kind of buzzing, continuous, and persistent noise may arise in this way, when the action of the muscles in question is brought forcibly into play.

§ 47. (43.) I have observed this in my own person. While in France, where immediate aus-

cultation is chiefly practised, I had much greater facility in auscultating in this manner than with the cylinder; the reverse became the case soon after my return to England. Of one thing I am certain, from the testimony of MM. Andral, Fournet, and others, that the physician might become a first-rate auscultator without ever using the stethoscope; though, for the reasons stated in the text, there can be little doubt that it is advisable to employ that instrument as constantly as possible. Yet it is common to hear the invention of the *stethoscope* spoken of as constituting Laennec's claim to immortality, whereas in truth the excessive affection he bore the instrument was one of the defects of that great man. No! his name will be imperishable, because he discovered *auscultation*, described accurately the sounds it detects, and traced these sounds to their anatomical causes.

I do not think it necessary to enter into any description of the numerous varieties of stethoscope met with at the present day,—all of them modifications of M. Piorry's. If the wood be light, the ear-piece somewhat concave, and the distal end small and well turned, all that is of practical importance in the construction of the instrument is secured.

§ 48. (44.) This, however, is to be understood with some qualification, for a good deal will depend upon the height of the observer. A tall person will find himself most at his ease if the patient be made to stand up. It is scarcely necessary to add, that in the statement made in the text the physician is supposed to have his choice of postures, but that it frequently happens the recumbent is the only one

which the patient can easily assume. It is under these latter circumstances that various flexible stethoscopes have been considered of practical utility, as they may be applied to the back of the patient without disturbing him. I confess I have no experience of these instruments; but I have never yet seen a case in which, so long as it was a matter of importance to auscult the chest, the patient might not be raised sufficiently by careful attendants to admit of the examination being efficiently made.

§ 49. (44.) It is well ascertained that Laennec exaggerated the frequency of ægophony; and it has been plausibly conjectured by M. Fournet that his error arose from the habit he had contracted, and which he recommended to his pupils, of applying the ear very lightly to the stethoscope when searching for that modification of resonance. At least it is certain that an ægophonic character may be sometimes given to a natural resonance by adopting this plan.

§ 50. (46.) It is only in very unusual cases that a direction of this kind is *necessary* to enable a practised auscultator to avoid the error referred to; though it may often be advisable to corroborate by its means the impression derived from ordinary examination. The sensation of *distant* production which attends the pharyngeal murmurs, and the occurrence of a distinct interval of time between inspiration and expiration (a point to which I particularly recommend attention), will suffice to distinguish them from the true pulmonary sounds. With ordinary attention, the observer may distinguish the two kinds of sound at the same time.

§ 51. (47.) The fact that the escape of air from the lungs during expiration is attended with audible sound was known to, and is distinctly stated by, Laennec (Forbes's translation, Amer. edit. p. 34.). The true importance of the respiratory murmur, the valuable indications its modifications afford in the diagnosis of disease, did not sufficiently attract his attention; and to the late Dr. Jackson, jun. of Boston, U. S., belongs the honour of conceiving the value and extent of information which might be obtained from its analysis. In a most ingenious paper, read in 1832 before the Medical Society of Observation of Paris, that zealous inquirer forcibly drew attention to the subject. M. Louis and several of his pupils submitted the remarks of Jackson to the test of observation: his announcements were found generally correct, and thenceforth the separate consideration of the expiratory sound became with them habitual. Dr. Cowan subsequently favoured the English public with a valuable paper on the subject (*Lond. Med. Gaz.* vol. xviii. p. 332.). Wherein, then, consist the originality and merit, in respect of the expiratory sound, of M. Fournet? Not assuredly in his having *discovered* it, nor in his statement of its value in the diagnosis of tubercles, nor even in his habit of investigating it in every state of disease. With respect to the latter point I may perhaps be allowed to say, that so early as 1833 I was in the habit of writing down, with the case of every subject I examined, the condition of the expiratory sound, even when the lungs were not diseased at all, and was in this way led to the conclusion (*vide* § 76.) that prolongation of it cannot

be correctly described as an isolated morbid phenomenon. All this would be matter of very little consequence, did not M. Fournet, rather by inference than direct assertion, arrogate to himself certain originality to which he has no claim. His real claims to distinction in this matter are, that he has investigated the subject more thoroughly than his predecessors, and especially that he has popularised what had previously been known only to the comparatively few: but he has fallen into repeated errors of over-refinement.

§ 52. (47.) In this statement of the properties of sounds, and more especially in the brief illustration of them which follows, my wish has been, in as few words as possible, to make the student acquainted with the different peculiarities he will meet with in the practice of auscultation. I have carefully avoided, as unnecessary at the bedside, all allusion to the theory of acoustics.

§ 53. (47.) I have, after some deliberation, determined upon including, under the head of special character, that property of sound known as its *timbre* or *quality*. This I do for the purpose of simplifying the subject as far as possible, without incurring any material sacrifice of accuracy; for I am perfectly aware that the *quality* or "timbre" of a sound is a different thing, acoustically speaking, from its *character*. Thus, two *tenor* voices (identical therefore in point of character) may sound the *same note*, in the same *rhythm*, with the same amount of *liquidness*, with the same *intensity*, and for the same *duration* of time, and yet a marked difference shall exist in the sensations impressed upon

the ear by the two notes: that difference depends upon their *quality*. This is a stronger example of its signification than that which I elsewhere gave some years past. (Vide *Br. and For. Med. Rev.* vol. ix. p. 302.)

Besides, I am persuaded from observation, which I believe to have been carefully conducted, that it is not always possible to appreciate, separately from their other properties, the *quality* of modified respiratory sounds. And it is perfectly manifest that M. Fournet has himself in many instances referred to *quality* conditions which are in reality compounds of various altered states of other properties.

§ 54. (47.) The student will not confound this signification of the term *rhythm*, as applied to a *single* sound, with its more common meaning in medical language when referring to the regularity and mode of succession of two or more distinct and separate sounds; as, for example, of the *two* respiratory murmurs.

§ 55. (48.) Accurate observers have long been in the habit of distinguishing the different properties of auscultatory sounds; but to M. Fournet certainly belongs the merit of carefully describing them and tracing their modifications. He has in my mind, however, fallen into a practical mistake in systematically attempting to describe the state of every one of these properties in each unnatural state of respiration: as observation proves that several of these properties are almost invariably altered simultaneously, such *compound states* may be described for convenience sake by single phrases. M. Fournet's plan involves not only useless minuteness,

but the chance of much error. Following it the anatomist, for example, should speak of the leg as the combination of certain muscles, nerves, ligaments, vessels, bones, &c., naming all of them, instead of using the compound term leg.

§ 56. (48.) Pulmonary respiration, the term originally applied by Laennec to the sounds of respiration transmitted from the proper tissue of the lungs, has given way to Andral's phrase vesicular respiration. Laennec's word appears to me preferable for the reason mentioned at § 57.

§ 57. (48.) Such, it appears to me, is the fittest term to describe the *character* of the healthy respiratory murmurs. They suggest in their pure state the sighing sound of the breeze among leaves, the only difference being one of intensity. The use of the term *vesicular*, in speaking of the natural condition of these sounds, has led to an erroneous impression. It was originally applied to designate the *seat* of their production; but not a few persons have incorrectly referred the term to the *character* of the sounds. There is nothing in the nature of the respiratory murmurs suggestive of a connection with vesicles, and whenever such character occurs the phenomenon it attends is morbid.

§ 58. (48.) It is obvious that there could be no means of assigning a *positive* value to the intensity and duration of the respiratory murmurs, even were they the same in all healthy individuals: experience only will enable the student to ascertain the ordinary amount of both. Respecting their relative value in inspiration and expiration, see § 60.

§ 59. (48.) These are the characters of the healthy

expiratory murmur, when, as is the case in the majority of individuals, it exists. But there are many subjects in whom it is utterly impossible, even by causing them to vary their mode of respiring in every possible way, to detect a shadow of expiratory sound. My inquiries on this point have been too numerous and too long continued to allow of my entertaining the slightest doubt of the accuracy of this statement, although M. Fournet appears to maintain the contrary. Where the expiratory murmur is altogether wanting I believe this to be a natural peculiarity, and in no instance the effect of disease. The exception which exists to this statement in some cases of emphysema is only an apparent one. (*Vide* § 231.)

The perfect similarity in all properties (except intensity and duration) of the expiratory to the inspiratory sound indicates that the *seat of its production* is the same as that of the inspiratory; namely, the ultimate parts of the minute tubes and the air-cells. This is confirmed by the fact that the period elapsing between the termination of the inspiratory and the commencement of the expiratory sound is an almost indivisible moment. I am aware that I here express opinions at variance with those of my learned colleague Dr. Williams, who considers the expiratory murmur to have necessarily the bronchial or tracheal character (*Lect.* p. 33.), and "suspects that it is chiefly transmitted from the upper parts of the respiratory passages, on which the expired air strikes with most force." (*Dis. of Chest*, 4th ed. p. 23.) That the sound produced in the pharynx and fauces by the egress

of the air may, and often is, mistaken for the true expiratory murmur, is unquestionable; but this does not prevent their being really quite distinct phenomena. (*Vide* § 50.)

§ 60. (48.) M. Fournet has given the numerical value as 5 : 1 to the ratio of the inspiratory to the expiratory murmur, in respect of intensity and duration; the proportion mentioned in the text appears to me to be nearer the truth. The ratio is not the same in all subjects; in which opinion I find myself at variance with M. Fournet, who maintains the affirmative. The important practical fact is, that in health the excess of intensity and of duration is always on the side of inspiration, and this to a considerable amount.

§ 61. (48.) This continuousness of the inspiratory and expiratory murmurs is an important character of *pulmonary* respiration of *healthy* type. It would of itself be sufficient to announce the lung as the part auscultated; for it will be found that in proportion as auscultation is practised at a further point from the pulmonary parenchyma, so will the two sounds be more and more distinctly separated from each other by an appreciable interval of time, —an interval which consequently attains its maximum opposite the larynx and upper part of the throat. In certain states of disease, however, a distinct interval is perceived opposite the vesicular section of the respiration organs,—a point I shall consider further with the subject of vesicular emphysema. Meanwhile I may observe that the facts now referred to seem sufficient in themselves to disprove M. Beau's doctrine of the respiratory mur-

murs; and it appears strange that they have not until now, so far as I am aware, attracted the attention of any observer.

§ 62. (49.) Laennec appears to have considered that the greater intensity of sound in infants than in adults is much more distinct in inspiration than in expiration (Forbes's transl., Amer. ed. p. 36.). I have not been able to ascertain this. In puerile respiration of the morbid kind (exaggerated respiration) the excess is on the side of expiration. (*Vide* §§ 71, 72.)

§ 63. (49.) Healthy *senile* respiration (as it may be called) differs from morbidly *weak* respiration in the increased duration of expiration. Andral has referred to its characters, and justly connects it with the rarefied state of the lung which arises, as a condition of natural decay, in subjects of advanced age. MM. Barth and Roger observe that "some old subjects *appear* to present, independently of pathological influence, a state of respiration like that of infants." I have never observed any thing of the kind.

§ 64. (49.) According to M. Fournet, the result of experience on this question is, that the murmurs are generally more marked superiorly than inferiorly, and in front than behind.

§ 65. (49.) I confess that my experience does not lead me to agree with Dr. Williams in the statement, that "over the space of from *one to two inches on each side* of the top of the sternum" the respiration has in the healthy state a bronchial character. As far as I have been able to discover, this is limited to the surface corresponding to the upper

part of the bone itself. The point is manifestly one of importance, and which it would be well were decisively settled.

M. Fournet would limit still further even than I have done the seat of natural bronchial respiration ; the interscapular region being, according to him, the sole spot in which it is usually audible. He even affirms that in some individuals the respiration is not of this kind, even in that situation ; an exceptional state, which he believes (upon the alleged evidence of post-mortem examination) to depend upon the roots of the bronchi being in those persons surrounded with a thick mass of pulmonary substance.

§ 66. (49.) It is held, I am aware, by some observers, that there is a slight difference naturally in the sub-clavicular regions; that the expiration is more prolonged, and both murmurs less soft, on the right than the left side. I have given this point much attention of late, and have invariably found either that the murmurs were precisely identical on both sides, or that if any excess existed on the right, there were coexisting circumstances to favour the belief of its *morbid* character. M. Fournet, who has been led by his own experience to the same conclusion, endeavours to show that the excess of caliber of the right bronchus over the left (the *cause* of the difference of the healthy murmurs, in the opinion of those who maintained its existence) is too trivial to account for any such dissimilarity. To inferences of this stamp, in either one direction or the other, no importance can, I think, be attached; the question is one of pure observation.

(See the same question, respecting vocal resonance, considered § 111.)

§ 67. (50.) The perfect similarity of the expiratory murmur in all parts of the chest is a most important point: it of course only exists where the respiratory murmurs are purely *pulmonary.* Where they are either *bronchial,* or have something even of a bronchial character, the statement in the text ceases to hold good.

§ 68. (50.) Commenting upon the effects of rapidity of respiration on the intensity of the murmurs, MM. Barth and Roger observe, that the commonly greater frequency of respiration in infancy is the most efficient cause of "puerile" respiration. The thinness of the walls of the chest holds in their estimation the second rank; the peculiar structure of the lungs, and the greater necessity for air at that age, the third.

§ 69. (50.) M. Fournet has drawn an elaborate, and in some points, it appears to me, rather fanciful parallel, between natural and morbid bronchial respiration. (*Op. cit.* p. 57.) As may be gathered from the texts to which this note refers, the main distinctions are the greater intensity and harshness of both sounds, and the greater proportional duration of expiration in the morbid variety. [§ 77.]

§ 70. (51.) The number of these types of abnormal respiration might, in conformity with observation, be increased; but in a work of the present elementary kind it does not appear advisable to carry division further. Familiarity with these types will certainly suffice for all practical purposes.

§ 71. (52.) *Puerile* respiration, so called on account of its similarity to the natural respiration of children, is termed also "*supplementary*," because the pulmonary tissue in which it is produced supplies by increased energy the loss sustained by the inactivity of some other part; and "*exaggerated*," because it is marked by exaggeration of some of the natural properties of the respiratory murmurs. There is this difference between the supplementary respiration of the adult and the natural respiration of infancy, that in the latter the excess of intensity and duration exists especially in inspiration (Laennec, Forbes's translation, Amer. ed. p. 36.), if it exist at all (*vide* § 62.); in the former, as stated in the text, the expiratory sound is proportionally more affected.

§ 72. (52.) According to M. Fournet, a modification of *character* is also to be detected in exaggerated respiration: he remarks that the murmurs acquire a slight blowing character; but this statement does not appear to me to be generally correct. The same writer states, I know not with what accuracy, that this kind of respiration is more frequently met with in front than behind, and at the lower than the upper part of the chest.

Undue prolongation of the expiratory murmur depending directly on disease may be distinguished from that of exaggerated respiration, by its being attended with modifications affecting the *special character*, *softness*, and *liquidness* of the murmur. In affirming here, and in the text, that in exaggerated respiration the intensity and duration of the expiratory sound are *disproportionally* increased, I

follow the results of my own experience. In these I am borne out by Fournet, while, on the other hand, Barth and Roger believe both murmurs to be equally affected.

§ 73. (53.) According to M. Fournet (*loc. cit.* p. 93.), when the normal respiratory murmurs are completely suppressed, there is still heard in some cases, towards the close of the movement of inspiration, a slight sound, "which appears to result from the lateral pressure, exercised on the pulmonary tissue, of the column of air which fails in entering the bronchial ramifications." For this sound he proposes the name of "sound of pulmonary compression." As I have elsewhere said, this phrase conveys to my mind no clear notion; but since becoming acquainted with M. Fournet's observation, I have had some opportunities of noticing the *fact* to which he refers. I cannot affirm that in the cases which came under my notice I was conscious of the occurrence of a distinct *sound*, though an indefinable sensation, referable no doubt to the cause assigned by M. Fournet, was perceived. The phenomenon is a different one from that first described by Dr. Williams, and referred to under the next head of *alteration of rhythm*.

§ 74. (53.) The peculiarities which I have described under the head of *incomplete respiration* were first distinctly noticed by Dr. Williams. (*Lect.* p. 35.) The inspiration is by him said to be "often abruptly stopped with a kind of *hic;*" of the condition of the expiration under these circumstances he makes no mention. It seems probable, *à priori*, that it will be affected with the converse deficiency

to that existing in inspiration; — that when the end of one is deficient, the beginning of the other will be wanting. This point would require very extensive observation, however, for its determination.

§ 75. (53.) That is, if their total length from the first formation of sound to the end be considered, including the intervening periods of pause; if the moments during which sound is actually perceptible be alone considered, the length of inspiration will be under the natural mark.

§ 76. (54.) In making *prolonged expiration*, the condition here described, which has attracted so much attention of late years as diagnostic of the earliest stages of tuberculization, a part of some one or other of the types of *altered character*, and in giving it no place as a distinct condition capable of existing alone, I follow my own observation. I have never yet met with an expiratory murmur of notably increased duration unattended with a change of *special character*, and therefore cannot but strongly doubt the correctness of those writers — for example, MM. Barth and Roger — who describe *prolonged expiration* as an isolated phenomenon. I admit, however, that in some cases the increase of duration is much more marked, and therefore more important in diagnosis, than the change of character (in many cases of tubercles and of emphysema for example).

The signification of the expiratory sound was in some degree mistaken by its re-discoverer Jackson [§ 51.]; he exaggerated its importance as a diagnostic sign of tubercles, and in this he has been very generally followed. Many persons forget that

what may appear in a given individual, as compared with another, *prolonged* expiration, is really in him a natural state; many confound with it the pharyngeal expiratory sound; and too few observers seem to be aware that under whatever circumstances an obstruction exists to the free circulation of air in the lungs, the expiration will be prolonged — an obstruction which (experience shows) never acts on the duration of the sound without affecting some of its other properties. The fact of obstruction appears to me to account satisfactorily for the phenomenon. Expiration is (unless in exceptional cases) sonorous under all circumstances: where the progress outwards of the air is rendered slower than natural, the most natural consequence in the world is that the attendant sound should be proportionally lengthened.

§ 77. (54.) This point in the history of bronchial respiration was first noticed by the late Dr. Jackson, of Boston, and has since been generalised by M. Fournet. This writer states that alterations in *character* always set in with the expiratory murmur, and only affect the inspiration secondarily. With this statement I find that my own experience accords in respect of chronic maladies: I believe it to be correct also in the very great majority of cases of acute alteration of the parenchyma of the lungs, as in pneumonia; and it it is probable that in the few exceptional cases in which a bronchial character has been detected in both murmurs simultaneously, the expiration may in reality have suffered first, and the period of its isolated affection been so short as to prevent its being observed.

§ 78. (54.) Under the name of *sarcenet sound* (bruit de taffetas), M. Grisolle describes a phenomenon apparently connected with bronchial respiration, though upon this point he is not very explicit. He represents it as resembling the noise made by tearing new sarcenet, or sometimes the crumpling of silk; always limited to inspiration; occurring in pneumonia as a transition sign between crepitation and bronchial respiration; of most frequent occurrence in the axilla, opposite the anterior edge of the lung and the outer part of the scapula. He considers it, on the evidence of *one* case, as characterising hepatization limited to the surface of the lung. (*De la Pneumonie*, p. 237.)

§ 79. (55.) This peculiarity of *quickness* of course is especially remarkable in the diffused and tubular (particularly in the latter) varieties of blowing respiration. Instead of the measured pace of natural respiration, rapidity and suddenness mark the evolution of these modified sounds, as is especially observable in extensive consolidation from pneumonia.

§ 80. (55.) The distinction of blowing from bronchial respiration is facilitated much by the consideration of the character of *quickness* just referred to: in the latter this peculiarity is not observed.

§ 81. (56.) Cavernous respiration is rarely attended with any very notable degree of the sensation of air being drawn from the surface and puffed back again, as referred to in a preceding paragraph of the text. This peculiarity does, however, sometimes exist, and appears to announce the close

vicinity of the seat of the phenomenon to the surface of the chest.

The *veiled puff* (souffle voilé) is a modified cavernous respiration, in which a "sort of moveable veil interposed between the excavation and the ear" seems to be agitated to and fro; at least such is Laennec's description, but few persons appear to have any experience of the phenomenon.

§ 82. (56.) The amphoric character has, however, in some cases, and these not a very few, appeared to me more strongly marked in inspiration than in expiration.

§ 83. (56.) The amphoric character may sometimes be detected in forcible respiration, when completely wanting if breathing be performed in the common way.

§ 84. (58.) This statement is true with respect to the sibilation occurring in *primary* bronchitis only; applied to that of the bronchitis secondary to emphysema, it requires modification. [§ 233.]

§ 85. (59.) The least attention on the part of the observer will prevent any chance of confusion between this variety of rhonchus and any form of pleural friction sound.

§ 86. (59.) The *dry crackling* rhonchus has been made a subject of very close investigation by M. Fournet, and some minute distinctions of its properties have been the result. But in respect of its diagnostic value, I find nothing in his volume with which I have not been myself acquainted since 1834, from having had my attention drawn to the subject by M. Louis. M. Fournet, is however, perhaps justified in his inference that it had hitherto

escaped general attention; not so the *humid crackling* rhonchus, which has been recognised and referred to by almost every writer on phthisis.

§ 87. (59.) M. Fournet has correctly pointed out that the nearer its period of origin the rhonchus may be, the more accurately is it limited to the inspiratory movement. In proportion as it acquires the humid character, which it inevitably assumes sooner or later, both movements are attended with rhonchus.

§ 88. (59.) In stating that the dry crackling rhonchus once *perfectly* developed remains commonly a persistent condition until the transition into the *humid* form is established, I wish to lay particular stress on the circumstance of its being so developed. While yet producible only by forced respiration, and appearing only with an occasional inspiration, it is liable to disappear for a day or two and then recur; but when once it has acquired sufficient perfection and stability to maintain itself steadily through a number of respirations, it apparently constitutes a persistent state. I think that this persistency may be commonly ascertained at an earlier period than that admitted by M. Fournet.

§. 89 (59.) According to M. Fournet, in cases of acute phthisis the transformation of the *dry* into the *humid crackling* rhonchus occurs in the majority of instances in from eight to twenty days: in from twenty days to two months and a half or three months in the chronic form of the disease. These statements respecting time must be received with caution, however, and are subject (as admitted indeed by this writer himself) to very distinct exceptions.

§ 90. (59.) This point was, I believe, first distinctly noticed by M. Fournet: I have repeatedly satisfied myself that the observation is a correct one.

§ 91. (59.) The most accurate comparison which has been made between the crepitant rhonchus and any other species of sound seems to me unquestionably that of Dr. Williams, who compares it to the sound produced by rubbing slowly and firmly between the finger and thumb a lock of one's hair near the ear. In every respect, both as regards the crepitations themselves and the entire act of crepitation, the similarity amounts almost to identity; but it must be remembered that it is to the perfect crepitation of primary pneumonia, and to this alone, that the comparison is to be understood to refer.

§ 92. (59.) Rapidity of evolution is an important property of the crepitant rhonchus, and among other characters serves to distinguish it from subcrepitation.

§ 93. (59.) Such is the general fact when the rhonchus is well developed; but the number of minute cracklings composing it may be fewer in number, indeed positively few. Respecting the conditions of the lung corresponding to these states of the rhonchus, some observations will be found in § 164.

§ 94. (59.) Dryness is one of the most marked properties of true primary crepitation; and for this reason, among others, the common use of the term "bubbles," in speaking of the tiny cracklings which constitute the rhonchus, is extremely inappropriate. The sensation is not that of "bubbles" bursting;

but rather of delicate tissue undergoing minutest ruptures with a crackling noise in many points simultaneously. So distinct is the sensation of dryness, that deference to established usage alone prevents me from placing this rhonchus with the dry class.

§ 95. (59.) When at its maximum the crepitant rhonchus accompanies the entire act of inspiration; when first developed, and when about to be superseded by blowing respiration, it appears towards the close of inspiration only. Under all circumstances it is, to say the least, rare to find this rhonchus coexistent in any degree with expiration; the statement that it may generally be heard to a diminished amount with this division of the respiratory act, appears to me to have originated in the confusion which long prevailed between the true crepitant rhonchus of pneumonia and the subcrepitant rhonchus of capillary bronchitis.

§ 96. (60.) This persistency is a feature of some importance as distinctive of crepitant rhonchus. Other rhonchi are manifestly influenced in the regularity of their production by the occurrence of expectoration for example; but over true crepitation this appears to exercise no immediate control,—at least the rhonchus persists with all its characters as before, after the patient has relieved himself by expectoration. The first effect of a fit of coughing, indeed, is to render the rhonchus more distinct and abundant even than before.

A fact which appears somewhat at variance with the above statement is, that occasionally crepitant rhonchus may be rendered audible by causing the

patient to breathe deeply, in spots where in ordinary respiration it is wholly absent. Under some circumstances this fact really constitutes an exception to the general statement; but I agree with MM. Barth and Roger that it is especially observable at the "end of the disease," consequently when the rhonchus has the character of the *redux* variety.

§ 97. (60.) Such are the ordinary characters of the rhonchus coexisting with the resolution of pneumonia. But in a certain number of cases its properties are much more similar to those of the primary variety: it possesses the same dryness, the same minuteness (I have never, however, observed redux crepitation of *greater* delicacy than the primary, as M. Grisolle appears to have done (*Op. cit.* p. 308.), and the same exclusive coexistence with inspiration. The observation of these facts, and of the vague manner in which the phrase redux crepitation is applied to the rhonchi existing in lungs undergoing the resolution of pneumonia, coupled with examinations made for the express elucidation of the point, has long led me to the conclusion that under that phrase are confounded two very different phenomena. These phenomena are a slightly modified subcrepitant rhonchus, and a true returning primary crepitation. The former (the rhonchus described in the text) is by far the most common, has all the characters of a humid rhonchus, and is, I can scarcely entertain a doubt, produced in the minute bronchial tubes; the latter, which affects the characters of primary crepitation, is probably generated in the same seat and manner as this. It will be observed that the rarity of true

redux crepitation is in perfect accordance with the theory of the primary rhonchus, which I have ventured to suggest in another part of this work [§ 165.]: it is in truth unlikely that the physical condition of the interstitial plastic exudation should often be similar at the two opposite periods of the malady, and hence improbable that a given phenomenon depending for its existence on that condition should frequently occur with identical characters at both those periods. But the thing may, *à priori*, be conceived a possible occurrence; and so we find by observation, that the effect which would follow did it occur—that is, the reappearance of the true primary rhonchus — *is* occasionally met with. On the other hand, were the primary rhonchus produced by bubbling in the interior of the vesicles, &c., as commonly supposed, there is no reason for imagining that the return of true primary crepitation should not be an invariable sequence of resolution.

The immediate cause of the subcrepitant rhonchus attending resolution, it appears to me, is the bubbling of air through the fluid contained in the minute bronchi; and this fluid may be the result either of capillary bronchitis, or be merely on its passage from the previously engorged and now œdematous lung. This latter opinion seems calculated to throw some light upon the cause of a circumstance with which auscultators are well acquainted; namely, that the redux *sub*crepitation of pneumonia sometimes lasts but a few hours, and at other times persists for weeks. (*Vide* § 237.)

§ 98. (61.) With the character of this rhonchus

I must confess I am not familiar. I describe it from the details given by M. Fournet, who considers it pathognomonic of active pulmonary congestion. The accounts given by this author, both of the rhonchus itself, and of the malady to which it is alleged to appertain, appear to me to demand the corroboration of other observers. MM. Barth and Roger, I perceive, regard the characters of the rhonchus as not sufficiently distinctive to require its separation as a species: such was the opinion I some time since expressed on the point (*Brit. and For. Med. Rev.*, April, 1840, p. 314.), and to which I now adhere. It appears to me, however, that if ulterior observation substantiate its existence with the properties attributed to it in the text, it must be esteemed a distinct *variety* of the species subcrepitant, as I have here provisionally made it.

§ 99. (62.) The causes of temporary cessation of cavernous rhonchus are — 1. Complete evacuation of the contents of the excavation; under these circumstances it is replaced by cavernous respiration: 2. Diminution of the contents to such extent as to bring the level of these below the bronchial opening or openings into the cavity; 3. Obstruction (by inspissated mucus or otherwise) of the bronchi communicating with the cavity.

§ 100. (62.) The cavernous rhonchus may be sometimes heard at a distance from the patient's chest, and the movement of the liquid perceived by placing the fingers on the spot, if the excavation be superficial. (See Rhonchal Fluctuation, p. 17.) Patients can sometimes indicate the seat of gurgling from the peculiar sensations they feel at the spot.

Indeed, as M. Fournet has remarked, the patient is often guided by his sensations to the site of the rhonchi dependent upon a much less advanced amount of disease,—for example, the humid crackling.

§ 101. (63.) I have elsewhere stated my doubts of the accuracy of M. Fournet's description of this "crumpling sound" and its varieties (*British and Foreign Medical Review*, April, 1840, p. 313.); and my own subsequent experience of three years, coupled with the opinion given by MM. Barth and Roger, has confirmed these doubts. M. Andral too, it appears from the statement of these latter writers, "confesses he has no fixed opinion on the sound in question."

There can be doubt that peculiar sounds of anomalous character, and which cannot be referred to any established class of audible phenomena, are occasionally — but rarely — produced in the lungs of phthisical subjects. Possibly these may be generated — some of them at least — in the manner M. Fournet suggests and would establish; but I cannot say that I have myself met with any sound suggestive of crumpling of the pulmonary tissue as its cause.

§ 102. (64.) The duration of each friction sound depends upon the extent of surface capable of giving rise to sound, and the freedom of motion of the lung. This freedom will in turn depend upon the dilatability of the lung,—a point of considerable importance (as shown especially by Dr. Stokes and M. Fournet) in explaining the absence of friction sounds in certain cases where the anatomical condition of the pleural

surfaces is favourable to their production. (*Vide* § 176.)

§ 103. (64.) Exceptional cases are sometimes met with, in which a sensation of moistness coexists with, and as it were forms part of, friction sound. M. Fournet states he has, by post-mortem examination, traced this peculiarity to humidity and softness combined in the opposed surfaces. If the false membrane be dense and hard on the surface, the friction sound will retain the dry character, even though that surface be accidentally bathed by a stratum of fluid.

§ 104. (65.) At the apex of tuberculous lungs I have not very unfrequently found a creaking sound, passing gradually into the rubbing variety, as the examination was made at a greater or less distance from the point where the sound was loudest. It is perhaps more common, however, to find the peculiar special character of the sound retained, though its intensity be much diminished, so long as it is audible at all. The allusion to frequency here must be considered altogether comparative; for, positively speaking, the existence of friction sound at the summit of tuberculous lungs is very rare.

§ 105. (65.) To Dr. Stokes and to M. Barth are due all the facts bearing upon laryngeal auscultation with which we are acquainted: to the former belongs the particular merit of leading the way in this field of research. To M. Barth's valuable paper (*Arch. Gén. de Méd.*, Juill. 1838, and Juin, 1839), and his section on the subject contained in the manual already referred to, I beg to acknow-

ledge my obligations in drawing up the short account I have given of the subject. Most of the observations of these authors I have verified myself.

§ 106. (66.) That the diseases of the larynx should not be attended with pathognomonic auscultatory signs is no more than we might expect, as they are the mere result of obstruction in that organ, and obstruction exists in almost every one of its affections. Still, by the help of comparative physical examination of the chest, as carefully pointed out by Dr. Stokes, and subsequently by M. Barth, a good deal of precise information may be obtained on the seat, and even on the nature, of laryngeal diseases. Some examples of this will be found in the tabular view of these maladies.

§ 107. (66.) It is a point of importance to remember that the intensity of the laryngeal sibilus is, generally speaking, in the direct ratio of the amount of obstruction in that organ.

§ 108. (66.) Croup is the affection in which, according to M. Barth, a metallic character most distinctly attends laryngeal sonorous rhonchus.

§ 109. (69.) According to Dr. Williams, natural bronchophony "sometimes" exists in the axillæ. (*Op. cit.* p. 32.)

§ 110. (70.) Dr. Williams maintains that shrill notes give more of *natural bronchophony* (that is, of resonance directly over the larger bronchial tubes), and grave tones more of general resonance over the thoracic surface.

M. Fournet affirms, in one part of his volume, that the general resonance over the chest is greater in infants than in adults; and elsewhere, that it is

greater if the voice be grave than shrill. Of these two statements, subversive of each other, the former is unquestionably incorrect.

§ 111. (70.) All my own experience is in support of the correctness of M. Louis's opinion, that in the space corresponding posteriorly to the origin of the right bronchus, the voice resounds more strongly than in the same part on the left side. I believe too, with Sir James Clark, that the natural résonance is more intense under the right than the left clavicle. In making observations upon this point, I took every possible precaution to avoid confusion of an unnatural with a natural state; more especially as the application of the fact to the diagnosis of early tuberculisation is as clear as it is valuable. (See the same question, respecting the respiratory murmurs, considered § 66.)

Dr. Stokes incidentally mentions his belief (*Op. cit.* p. 497.) that the same superiority, which I have now admitted to prevail under the clavicle, extends to the entire right side. As may be gathered from the text, I do not consider myself justified in adopting this opinion; nor, on the other hand, do I feel competent to question its correctness. The fact is, that so far as I have availed myself of opportunities of examining the point, the results did not bear out Dr. Stokes's announcement; but I have not availed myself of them with sufficient frequency to warrant any contradiction of a statement emanating from so distinguished a source.

§ 112. (71.) It has been remarked by Dr. Skoda that bronchophony is not always a persistent phenomenon in hepatization; that at one time the

resonance is very strong, at another equally weak. The cause of the occasional disappearance of resonance he conceives to be the obstruction of the bronchial tubes of the hepatized part by fluid matter, for the resonance reappears readily when the patient makes a deep respiration or coughs. This observation is cited by Dr. Skoda as strongly supporting his theory of consonance as explanatory of morbidly increased resonance. (*Vide* § 189.)

§ 113. (72.) This character of ægophony is essentially one of short duration: the displacement of the fluid either ceases to be possible from the interference of plastic exudation, or the quantity of fluid increases to such a degree as to exclude altogether the conditions of its development.

§ 114. (73.) The varieties of pectoriloquy established by Laennec—perfect, imperfect, and doubtful—are not admissible. Pectoriloquy with the characters assigned in the text exists, or it does not; the varieties described by Laennec being really referrible to bronchophony. Laennec's error arose from his assuming that pectoriloquy must always exist when excavation is present. Whatever resonance he encountered in connection with excavation he was therefore obliged to style pectoriloquy. [§ 196.]

§ 115. (73.) According to MM. Barth and Roger, pectoriloquy is liable to assume this ægophonic character when the excavation furnishing it is of flattened form, and provided with walls capable of moving backwards and forwards under the influence of vibration.

§ 116. (75.) Observers differ somewhat in their

statements of the mode of coexistence of metallic tinkling with the respiratory movements. M. Fournet places it among the phenomena coexisting with both inspiration and expiration, but especially with expiration. According to MM. Barth and Roger, it coincides ordinarily with inspiration, rarely with expiration alone, sometimes with both. I have stated in the text what, I believe, I have myself observed in respect of this point.

§ 117. (80.) I have not observed any particular change in the functions or sounds of the heart in connection with the displacement described. Larrey has related a case in which extreme feebleness of the pulse in the large arteries co-existed with it; there can be no certainty, however, that there was any mutual dependence between the two circumstances. Dr. Hope describes the following peculiarity in a case of right lateral detrusion from effusion in the left pleura. "The aorta was felt to pulsate between the second and third right ribs, an inch from the sternum, and here a murmur was heard with the first sound, which has *ceased* since the heart has been restored to its natural situation by the absorption of the fluid. Is it, therefore, possible that a twist given to the aorta, or pressure of the vessel against the ribs, may be the cause of a murmur under such circumstances?" (*Diseases of the Heart*, ed. 3. p. 536.) On the other hand, Dr. Stokes's experience is to the same effect as my own: the examination of upwards of twenty cases has convinced him, that, even when at its height, this displacement "does not cause any alteration in the natural sounds of the organ; indeed, it is singular how little its

action is excited in many of these cases." (*Op. cit.* p. 500.)

§ 118. (84.) I believe that Dr. Williams has assigned the true cause of the rarity of expansion in hydrothorax, namely the commonly limited amount of effusion. Dr. Stokes explains the fact otherwise, as the reader will find by referring to § 123.

§ 119. (84.) The only circumstances under which I have distinctly observed dilatation of the chest, as an apparent result of hypertrophy of the lung (and this I have done very recently only), are the existence of chronic pleurisy with retraction to a great extent on one side, while the lung on the other has been perfectly free from organic disease; for in such a case hypertrophy cannot be regarded in the light of a malady.

§ 120. (84.) General expansion is a very uncommon attendant on emphysema; a fact recognised by MM. Louis (once in 96 cases), Woillez, and others. It does sometimes exist, however, and the chest then presents an almost globular form, the expansion being very distinct both anteriorly and posteriorly; the intercostal spaces appear widened, and their external surface is on a level with the ribs, instead of being more or less sunken.

§ 121. (84.) M. Sanson states (*Dict. de Méd. et de Chir. Pratique*, art. "Plaie,") that he observed distinct enlargement of one side of the chest produced by extensive effusion of blood into the interior.

§ 122. (84.) Broussais was the first to affirm that the lung, when hepatized through its entire extent, might dilate the corresponding side of the

chest. Laennec, as is well known, combated this notion most energetically, and the force of his objections was admitted by Andral. More recently, M. Woillez has also maintained the negative, justifying his opinion by a reference to the physical relations of the lung to its containing cavity, corroborated by the results of direct mensuration in *two* cases; in neither of these instances was the least degree of expansion detected. M. Grisolle obtained similar results from circular and antero-posterior admeasurement in *four* cases: nevertheless he believes, upon the evidence of two others, that the inflamed lung may, quite independently of pleuritic effusion, determine "general or partial dilatation." In one of these, slight bulging of the infra-clavicular region (the disease occupied the upper lobe, and especially its anterior part) was detected on the patient's admission, the third day of the affection. This bulging having gradually increased with the progress of hepatization, M. Grisolle considers himself justified in referring its appearance to the inflammation of the lung; the post-mortem examination proved the absence of pleuritic effusion. In the other instance, bulging of the infra- and post-clavicular regions was observed to subside gradually with the resolution of the disease. (*De la Pneumonie*, p. 226.)

It will be observed that neither of these cases proves the fact of *general* expansion, as admitted by M. Grisolle; and although there does not *appear* to be any plausible objection to the cases referred to, as demonstrating the occurrence of *partial* expansion, it may perhaps be better to wait for further

evidence on the subject, before definitively admitting the general proposition they support.

In cases of pleuro-pneumonia, expansion, but more commonly bulging, may take place, as the effect more of the liquid effusion than of the increased mass of the lung.

§ 123. (84.) The state of the intercostal spaces in parts of the chest which have undergone expansion or bulging has been made a subject of interest by the observations of Dr. Stokes. He maintains that in emphysema, "even after great dilatation of the chest has occurred, we see the intercostal spaces, so far from being obliterated, *deeply marked;*" and that the single malady in which this obliteration really occurs is pleurisy in its advanced stages. The conditions directly conducive to its production are *paralysis* of the intercostal muscles and excentric pressure, one being as essential as the other; this paralysis is presumed to be the result of inflammation extending to the muscular tissue. For the same reason, the intercostal spaces will not be obliterated in cases of simple hydrothorax, nor in *all* instances of pleuritic effusion; because muscular inflammation and paralysis do not exist at all in the former, and are not *necessarily* present in the latter.

The question here started is strictly one of observation; and it must be confessed that the experience of physicians generally does not accord with that of Dr. Stokes in respect of the bulging of emphysema. MM. Louis and Woillez (not to mention others who have paid less special attention to the form of the chest in emphysema) are wholly opposed to Dr. Stokes on this point. Both maintain

that the intercostal hollows are in this affection either effaced or manifestly less marked than in the natural state; and even point out this implication of the muscular plane of these spaces as one of the distinctive marks of emphysematous, as compared with rachitic, or with "physiological," heteromorphism. Having been for some years acquainted with the difference of opinion now exposed, I have made the point a subject of enquiry, and have satisfied myself that in emphysema the conditions in respect of bulging are of three distinct kinds. *First*, there may be no expansion at all, general or local; *secondly*, there may be bulging of the surface generally, with a natural state of the intercostal spaces; and *thirdly*, there may be bulging with distinct obliteration of the intercostal spaces. The key to these apparent contradictions lies mainly in the anatomy of the disease—in its anatomical varieties, which have in this point of view escaped the consideration of the observers referred to. In the *first case* I have found the disease, which, in respect of symptoms, may have been very intensely marked, of the *atrophous* kind; here the physical cause of expansion was altogether wanting. The *second variety* of heteromorphism I have never observed in the infra-clavicular region (when alteration of shape was limited to that region, one of the special seats of such change in emphysema), but have met with it elsewhere in certain cases of almost globular expansion of the thorax in emaciated emphysematous subjects. But in these instances—and doubtless they exist more frequently than they are discovered or suspected—the local

heteromorphism (when characterised in the manner now referred to) was in all probability, especially when occurring at the back, physiological, and wholly *independent of the emphysema. Thirdly*, when bulging has existed in regions where observation proves it to appertain specially to emphysema,—e. g. the infra-clavicular,—I have found the intercostal spaces distinctly obliterated, and the disease, if opportunity for post-mortem inquiry presented itself, of the *hypertrophous* kind.

The difference of opinion under consideration appears to be very readily explicable in the manner now proposed. What I have stated I believe to be in strict conformity with observation; whereas I am not aware that Dr. Stokes's theory, of inflammation of the intercostal muscles being a necessary condition of their excentric displacement, rests upon any observed cases, submitted to anatomical examination. It is not easy to understand, in his theory, why the intercostal muscles should resist excentric pressure more powerfully than the ribs; and this, be it noted, equally in subjects of every degree of muscular weakness or vigour. It appears to me that there will always be more or less hollow in the intercostal spaces, as has been shown by M. Woillez, so long as the elasticity or concentric force of the lung is not destroyed; that as soon as this change has taken place, as, for example, from the progress of hypertrophous emphysema, pressure sets in and influences the position of the intercostal muscles at least as readily as that of the ribs.

§ 124. (84.) The influence of fatty liver in enlarging the hypochondrium has been distinctly made

out by M. Woillez; and as that anatomical state of the liver is, in France, almost peculiar to phthisis, inspection of the right hypochondrium may in that country throw indirect light on the diagnosis of tuberculous disease: other conditions, however, it is to be remembered, may produce similar enlargement of the hepatic region. And in this country the point is scarcely of the least importance, for fatty liver (as I have, with others, ascertained by numerous observations) is, with us, comparatively very rare in phthisis, while, on the other hand, it occurs more frequently than in France in other maladies.

§ 125. (86.) Dr. Williams states, that in certain cases he has found the contraction of the chest following circumscribed pleurisy insufficient to fill up the space left by the absorption of the fluid, and a partial pneumothorax (ascribed by him to secretion of air from the membranes) filling it instead. This must be singularly rare; more especially as contraction of the chest following idiopathic circumscribed pleurisy has itself been noticed by Dr. Williams only, so far as I am aware. *Partial contraction*, after ordinary *general pleurisy*, is quite a different thing, and of very frequent occurrence. (*Vide* § 126.)

§ 126. (85.) The only change of shape described by Laennec as consequent on the absorption of the fluid effused in general pleurisy was general retraction of the side. M. Woillez has, however, drawn the attention of observers to the fact (which nothing but the force of Laennec's authority could have prevented them from seeing before) that partial retraction, in other words *depression*, is of vastly more frequent occurrence than the general variety. In-

deed the fact was not unknown, but not sufficiently dwelt upon by writers. The subjoined table gives the result of M. Woillez's experience on this subject; and for a minute account of the characters of each depression I beg to refer to the volume itself (p. 456.). Here will also be found some plausible explanation of the more usual occurrence of the different partial retractions.

It would follow from the table, that retraction is more common in pleurisy of the right side than the left: —

Retraction.	Pleuritic Effusion.		
	Right Side, 10 Cases.	Left Side, 9 Cases.	Total, 19 Cases.
a. *General* - -	1	0	1
b. *Partial:*			
Anterior - -	4	0	4
Antero-lateral -	1	0	1
Antero-posterior	1	0	1
Posterior - -	1	3	4
Postero-lateral -	0	1	1
	8	4	12

§ 127. (85.) Dr. Stokes is of opinion that retraction of the walls of the chest may occur in the advanced periods of pneumonia, when no suspicion can exist of the presence of pleuritic effusion. Contraction may be observed, he states, in cases where the lung has been long indurated and still continues impervious, and may even coexist with gradual and ultimately perfect resolution. In all cases where he has observed this contraction, the primary disease has been of the *typhoid* type; in one instance of

this kind, the contraction seemed to affect the whole side more than is general in pleurisy; in other cases it was very similar to that of empyema. (*Op. cit.* p. 335.) Dr. Stokes does not attempt to explain the manner in which the contraction is produced.

M. Woillez (believing himself original) has since professed somewhat similar notions. He maintains, however, that where contraction occurs in pneumonia, there has always been some effusion into the pleura — in fact, pleuro-pneumonia, — and that the process of contraction is the same as in simple pleurisy. In cases of pleuro-pneumonia of the right side, the anterior surface only collapsed; in those affecting the left, the posterior surface: I do not believe that this relation is constant.

M. Grisolle adopts the same views respecting this question as M. Woillez; in nine cases of *simple* pneumonia, antero-posterior and circular admeasurement failed to detect any diminution of size during the progress of convalescence.

Some years since I observed a case of extensive pneumonia of the left side in which indisputable depression of the *latero-anterior* part of the chest gradually took place during the progress of recovery. As far as physical and symptomatic evidence can decide the point, there was certainly neither notable pleural exudation nor liquid effusion in this instance; but, as in Dr. Stokes's cases, there was no post-mortem examination to decide the question. I cannot, I confess, help feeling persuaded, that *simple* pneumonia may entail the alteration of shape, which, as I say, I believe I have actually witnessed. Perhaps, all things considered, the most efficient agent

in producing depression of the chest after pleurisy is the contraction of the plastic matter exuded on the pleural surfaces: why should not the same contraction (occurring as a law of its existence) of exudation poured into the substance of the lung cause *similar* alteration in the form of the thorax? I say similar, not the same in amount, because, in the case of pleurisy, there is another well-known cause of heteromorphism, which does not exist in the instance of pneumonia. It appears curious that M. Grisolle, who professes to have seen the size of the lung, increased by interstitial exudation only, gradually return to its natural state, should maintain depression of the surface to be impossible. What is to prevent the diminution of bulk from gradually bringing the lung to a less volume than in health; and this once effected, will not depression of the parietes inevitably follow?

§ 128. (86.) Lowered position of the nipple is of more value as a sign of absorbed pleuritic effusion on the right than on the left side; for it sometimes occurs, independently of all disease, on the left. (*Vide* Table, § 8.)

§ 129. (86.) Elevation of the shoulder on the side retracted from chronic pleurisy is so extremely rare, that I am not acquainted with any other example of the fact than that which I have described and figured in the article "Empyema" in the *Cyclopædia of Surgery* (vol. ii. p. 103.). I confess myself unable to account for this departure from the ordinary state of things.

§ 130. (87.) I am not able to state the proportion of cases in which lateral curvature of the

spine occurs; but it is certainly comparatively very small.

§ 131. (87.) The ribs are the subjects of two kinds of displacement in cases of chronic pleurisy; *procidentia* affecting more especially their external convex part, and *distortion*. The latter, which depends on a twisting of the bones on their longitudinal axis, has been particularly described by M. Woillez. In consequence of the torsion of these bones, their superior border becomes external, their inferior internal; while their surfaces, external and internal in the natural condition, become inferior and superior. The individual must be very thin to enable the observer to detect this condition of the ribs, as admitted by M. Woillez; and I must confess, for my own part, that I have rather found the species of distortion in question in progress towards, than actually amounting to, the degree just described.

§ 132. (87.) It will be understood that whenever diminished motion of expansion and of elevation exists in inspiration, expiration will be attended with a similar diminution of retraction and depression.

§ 133. (87.) The cause of the diminished motions in pleurisy differs at the different periods of the disease. At first the diminution depends upon the instinctive effort of the patient to keep off the pain which full expansion invariably produces; in the advanced periods, it results from mechanical interference. The influence of pain is demonstrated by the fact that in some cases where this has abated the motions acquire greater freedom, until they are again obstructed by the accumulating fluid.

In cases of considerable fluid accumulation and also of retraction after absorption, the affected side at its lower part seems slowly dragged upwards, later in point of time than the expansion and elevation of the opposite side.

§ 134. (87.) The older authors taught that in pneumonia the motions of the chest were greatly diminished, to such a degree that when both lungs were implicated the respiration became completely abdominal. Laennec brought statements of this description into discredit by affirming he had "repeatedly assured himself that the dilatation was equable in cases of peripneumony confined to one side." (Forbes's transl., Amer. edit., p. 16.) The testimony of later authors is contradictory. M. Fournet places "acute and chronic hepatization of a large portion of one of the lungs" among the causes of diminution (especially in point of *extent* as compared with *intensity*) of the thoracic motions. M. Grisolle, on the other hand, has invariably found the dilatation of both sides equal in cases of pneumonia, unless when pleuritic pain of severe character existed; the enlarged mass of the lung has, according to him, no influence in modifying the motion of expansion, as this became natural when the pain abated.

I have not the least doubt, for my own part, that the motions of the chest are diminished in simple pneumonia with extensive consolidation, quite independently of the influence of severe pain. But the motion of elevation is not by any means so much obstructed, according to my observation, as that of expansion; a circumstance which will perhaps ac-

count for the contradictory opinions held on the subject. In certain cases of pneumonia with a slight amount of plastic exudation on the pleural surfaces, friction phenomena are not to be discovered. To what can this be attributed but, as elsewhere explained (§§ 102. 176.), to the diminished expansion of the lung and deficient mobility of the thoracic walls?—while, on the other hand, it would be preposterous to explain the diminished motion by the interference of the slight pleuritic exudation supposed.

§ 135. (87.) Laennec denied that inequality of action of the walls corresponding to portions of lung unequally filled with tubercles was an invariably observable condition. Andral maintains, on the contrary, that distinct immobility of the surface over tuberculous deposit may be detected to a greater or less amount, especially if chronic inflammation exist around the tubercles. Dr. Forbes (Transl. of Laen., ed. cit. p. 16.) has "certainly observed" this partial immobility; and Sir James Clark has described it with particular care. (*On Pulmonary Consumption*, p. 33.) M. Fournet has, with more precision than other writers, distinguished this diminished motion as affecting partially the costal or partial movements; the general motions, according to him, undergoing no very obvious change in phthisis. He has not detected it to any notable amount, except when infra-clavicular depression existed; and believes that it may be observed in about one fourth of phthisical cases in their first stage: its frequency increases with the advance of the disease. We may infer, from its

not existing unless as an attendant on depression, that pleuritic false membrane is its immediate cause. It was most frequently observed on the right side. I would remark that M. Fournet's statement as to the non-occurrence of diminished *general* motions in phthisis requires qualification; where considerable formation of pseudo-membrane in the pleura complicates the tuberculous disease, those motions are distinctly obstructed.

§ 136. (91.) This rhonchal fremitus may be made the means of estimating roughly the distance of the seat of the rhonchus from the surface: if near, according to Laennec, there will be perceptible vibration; if distant, none. Dr. Stokes considers it more distinctly perceptible during inspiration than expiration, in the child and female than in the adult male, and at the middle and inferior parts of the chest than the superior. I have found it very remarkably developed in infants of from six to twelve months old.

§ 137. (91.) Dr. Stokes considers that this rubbing vibration is "obviously connected with the most unorganised condition of the effused lymph," and accordingly, during the progress towards cure, is the first of the physical signs to subside. (*Op. cit.* p. 468.)

§ 138. (92.) The profession is indebted to Dr. Graves for the description of this sign. Each pulsation of the heart in his cases was felt all over the front of the right lung; the impulse was not lateral but diastolic, so as to simulate an aneurismal pulsation. MM. Hourmann and Dechambre (*Arch. Gén. de Méd.*, 2ème série, t. xii. p. 59.) state that

they observed in a case of pneumonia a sort of *vibration*, isochronous with the impulse of the heart, over the entire of the anterior surface of the left side. Whatever further observation may determine respecting the utility of this alleged sign, that it is of extreme rarity is proved by general experience. M. Grisolle in particular has examined 70 pneumonic patients with a special view to its detection, without being once successful in his search.

§ 139. (92.) MM. Barth and Roger seem, from their description, to believe that whenever a cavity is superficial, and the seat of cavernous rhonchus, fluctuation may be felt by the fingers applied to an intercostal space opposite. The phenomenon has, on the contrary, appeared to me one of very rare occurrence.

§ 140. (93.) Instead of a mean excess of one centimetre and a half on the right side, as in healthy subjects, M. Woillez found that the excess in emphysematous patients averaged only three tenths of a centimetre, showing by inference the greater frequency of emphysema of the left side.

§ 141. (97.) Dulness of the sound under percussion is not a constant attendant on dilatation of the bronchi, even where this is so considerable as to give cavernous respiration and pectoriloquy; M. Louis's eleventh case (*Phthisie*, p. 235.) proves this. Were the state of things, in this respect, always as in that exceptional case, the diagnosis of dilated bronchi would be far easier than it is.

§ 142. (98.) A cavity answering to the description given in the table is to a great degree in

the condition of pulmonary substance underneath the resisting plane formed by the sternum, and hence it is that the phenomena of percussion are somewhat analogous in the two cases. (*Vide* § 32.) It is very rare, however, to meet with a cavity yielding a clear sound unaccompanied by the amphoric character; and as is well known, it is, absolutely speaking, rare for clear sound to be detected under any circumstances opposite a cavity. [§ 21.]

§ 143. (100.) By using the word *slight* here I do not mean it to be inferred that the same sign may not be discovered where the induration is considerable; but simply that it is in cases of *slight* disease of the kind that the sign may be made useful for diagnosis. The induration is in truth supposed to be so inconsiderable, that the sound on the affected side is quite as clear as on the opposite one in the ordinary state of respiration.

§ 144. (101.) Exaggerated respiration, though not a *direct* result or sign of disease, furnishes valuable *indirect* evidence of its existence, and bears the same relation to the cause producing it as (to use the happy expression of Fournet) the shadow to the substance. It occurs in the tissue adjoining portions of lung rendered unfit for the purposes of respiration, either by *obstruction*, *condensation*, or *rarefaction*. The closer the examination is made to the actually diseased part, the more intensely will the exaggerated respiration be found to be developed. When the entire or much the greater portion of one lung ceases to admit air, the whole opposite organ becomes the seat of exaggerated

respiration; when the disabled portion of lung is of limited dimensions, the extent of surface over which supplementary or exaggerated respiration is heard is proportional to those dimensions.

§ 145. (101.) Exaggerated respiration, as a consequence of the presence of a foreign body in a principal bronchus, is much more frequent on the *left* than the right side,—for the simple reason, that foreign bodies almost constantly make their way into the *right* rather than the left bronchus. (See Stokes, *Op. cit.* p. 285.)

§ 146. (101.) Exaggerated respiration on the surface may sometimes become a valuable sign of deep-seated pneumonia. In a case which recently came before me, this phenomenon, the general symptoms, and slight pain in the side (the patient had spit a little, but could not describe the appearance of the sputa) were the only circumstances warranting the diagnosis of central pneumonia,—a diagnosis amply confirmed by the ulterior progress of the case.

M. Grisolle (*Pneum.* p. 231.) is of opinion that "in the great majority of cases, if not in all," weakness of respiration, often attended with "loss of purity and of softness," marks the outset of pneumonia. In order to ascertain the existence of this condition, the observer must make his examination at a very early period of the malady. I have not myself been fortunate enough to detect this species of change in the neighbourhood of inflamed lung, and I confess the phrase "loss of purity" does not convey any accurate notion to my mind. (*Vide* § 148.) M. Grisolle also states, that he has in a

large proportion of cases found *weakness* of the respiratory murmurs in the *neighbourhood of already hepatized lung*, the prelude to the signs of consolidation.

§ 147. (101.) I am not aware that the existence of exaggerated respiration has been noted by any author, as occurring in the neighbourhood of circumscribed portions of lung rarefied by vesicular emphysema. I have, however, distinctly observed this in some few cases; but am not yet able to assign the proportion of instances in which it exists, or the circumstances influencing its presence or absence. It certainly is not a constant phenomenon.

I have not in the cases referred to been deceived, I am perfectly satisfied, by any abnormal variety of respiration produced in an actually emphysematous part. At least, I have taken all necessary precaution to avoid such deception, by attending to the form of the chest, the sound under percussion, and the precise condition of the other properties of the respiratory sounds in addition to their intensity and duration; all these circumstances were opposed to the existence of emphysema in the part of the organ presenting the modified state of respiration which I believe to have been the exaggerated.

§ 148. (101.) The occurrence of exaggerated respiration in a lung affected with hypertrophy, is the only example I am acquainted with of the undoubted production of this state in tissue actually presenting an organic deviation from the natural state. But as this hypertrophy only occurs in a lung when the opposite organ is, and has for some time been, incapacitated from performing its function, the occur-

rence of exaggerated respiration may with as much, and probably more justness, be ascribed to the inaction of its fellow, than to its own hypertrophy. The best example of the fact is furnished by cases of chronic pleuritic effusion with contraction of the same side, and hypertrophy of the opposite lung.

§ 148. (101.) Dr. Stokes some years since announced his belief that "an intense puerility of respiration *in the affected part*," combined with fever and excitement of the respiratory system, will justify the diagnosis of the first stage of pneumonia — that first stage being one anterior in development to the earliest anatomical change admitted by Laennec. I perfectly agree with Dr. Stokes in this statement, if the words "in the affected part" be omitted. (See § 146.) It seems in truth infinitely more probable, and more in accordance with what is known generally of it, to believe that the exaggerated respiration observed in connection with incipient pneumonia is produced in tissue still possessing the natural properties.

Dr. Williams professed in 1838 (*Lectures*, p. 110.) that "the natural respiratory murmur *will be* rendered rough, and perhaps sharper, before the crepitation begins;" but in the last edition of his work on *Diseases of the Chest* (p. 131.), he modifies the force of this phrase in the words—"at first the obstruction *may* only give a slight roughness and sharpness to the breath-sound."

§ 149. (102.) In the first of these varieties — the superficial — the weak respiration appears to be produced close to the ear; in the other, at a distance.

A consideration of the causes of the two varieties will readily explain the difference. In the latter, the portion of lung in which the weak murmurs exist is in reality removed to a certain distance from the walls of the chest by the intervention of adventitious fluid or solid matter; in the former, no such removal of the pulmonary substance occurs.

In applying the word *persistent* to a sub-variety of the *superficial weak respiration*, I mean simply to mark its not being of an interrupted type: the contrary is the case with the *intermittent* sub-variety; and this intermittence constitutes an important feature in the physical signs of a foreign body in the bronchus, depending manifestly upon its motions from place to place, and consequent greater or less interference from time to time with the entry of the air.

§ 150. (102.) This cause I give on the authority of Dr. Williams. (*Diseases of Chest*, 4th ed. p. 95.)

§ 151. (104.) In the case of inspiration deficient at the close in hepatization of the lung, Dr. Williams considers the phenomenon caused by the *sudden* stoppage of the expansion of the lung. Were this the sole cause, however, there is reason to suppose that its occurrence would be more frequent than it is.

§ 152. (104.) Although jerking respiration is referred to more or less distinctly by a few authors as an attendant on tubercles, and by Dr. Stokes in particular spoken of as "indicating the first stage of tubercular irritation" (*Op. cit.* p. 397.), it has attracted but little general attention, either simply as a physical sign, or as a means of diagnosis. That it is a really valuable evidence of incipient tubercle,

I can, from my own observation, affirm, having met with it at a period of the disease when the physical signs generally are few in number, not so decisive as might be wished, and when, of course, every addition to their number is really important. According to my experience, it is a persistent phenomenon. I have not, as Dr. Stokes appears to have done, succeeded in removing it by local treatment,—even in cases where other signs, *e. g.* harshness of respiration, were favourably modified by that treatment. Its cause or mechanism is not very easily assigned. When I first observed it, I was induced to attribute it to some influence of the heart's pulsation; but the error of this notion was almost instantly proved by the absence of the jerking inspiration in parts of the lung more directly exposed to such influence of the heart than those in which it existed. I have met with it both at the right and left summits anteriorly, never yet posteriorly; and in cases where, as I have said, the other physical signs were distinctly those of tuberculization more or less advanced, but still not having proceeded to softening. Barth and Roger consider that it depends upon the obstruction thrown in the way of pulmonary expansion by the adhesions which so frequently form about the tuberculised apices of the lungs.

Since writing the above, I learn from Sir James Clark that he has long been familiar with this state of respiration, as an attendant on the earlier stages of phthisis.

It is stated in the text (p. 53.) that the jerking rhythm is not perceptible in the expiration, and such is commonly the fact. Barth and Roger find a ready

explanation of this non-existence in the passive condition of the lungs during the expiratory movement. It is not, however, always wanting in expiration. I have recently (June 22. 1842) observed a case in which it was present to quite as marked an amount in that murmur as in the inspiratory.

I have also not very unfrequently succeeded in detecting jerking respiration at the lower part of lungs, presenting the signs of cavities at the summit and upper part. Its presence in this situation lends support to the theory of its causation advanced by Barth and Roger.

§ 153. (106.) It appears probable (but I am unable to support the notion by reference to post-mortem examination) that the *diffused* blowing respiration is transmitted from a number of small bronchi, the *tubular* from a very few large ones. Were this the case, the change in character from *diffused* to *tubular blowing* would be referable—in pneumonia, for example—to the compression and obliteration of the smaller bronchi, corresponding to the increase in extent and amount of solidification, and would account for the fact (which I believe I have frequently observed) that the well-marked *tubular* variety signifies a more advanced degree of disease than the *diffused.*

Among the physical conditions most favourable to the perfect development of the different varieties of blowing respiration is emptiness of the space in which they are actually produced, and from which they are transmitted by dense tissue to the ear. This is true of all the varieties; and hence true whether the seat of the phenomenon be the bronchi, an excavation in the substance of the lung, or the

pleural cavity communicating by a perforation with the bronchi. If the bronchi or pulmonary cavity contain fluid, the tendency will be to the production of various liquid rhonchi instead; and hence the phenomena, for example, of cavernous rhonchus and cavernous respiration are always in the inverse ratio of each other as regards degree and perfection of development.

There is a condition under which I have frequently observed the diffused variety of blowing respiration, and where it is likely, unless the examination be conducted carefully, to deceive the observer. In certain cases of tuberculous excavation, auscultation may be performed in two or three places without cavernous respiration with the hollow metallic character being discovered, the diffused variety of blowing respiration being the condition detected: were further investigation not made in such cases, the lung might be considered the seat of simple solidification. By moving the stethoscope carefully over the entire surface, cavernous respiration is usually detected, and the evidence of excavation established. In these cases the cavernous character is evidently masked by the diffused blowing, which is the result of the condensation existing around the excavation. This is one reason why a cavity may escape discovery, unless the examination of the chest be very carefully performed.

§ 154. (107.) In illustration of what has been said in § 153. respecting the presence or absence of fluid in cavities as modifying the phenomenon of blowing respiration generally, the following points may be stated respecting its cavernous variety:—

1. A cavity may exist in the lung without cavernous respiration, if the excavated space be filled with fluid: under these circumstances, cavernous rhonchus only will be present. 2. The more completely free from fluid the excavation, the more perfect will be the cavernous respiration. 3. If an excavation be partly filled with fluid and partly with air, the conditions observed are of three kinds: *a.* When the quantity of liquid is small, and the bronchus communicating with the excavation opens above the level of the liquid, pure cavernous respiration will be heard. *b.* When the communication with the bronchus occurs below the surface of the liquid, cavernous rhonchus is heard alone. *c.* When a double communication exists, that is, above and below the surfaces of the fluid, common rhonchi and respiration will be both present. All this has been *observed* by myself and others.

§ 155. (109.) Laennec taught that the cause of sibilant rhonchus in acute bronchitis was alteration of the caliber of the bronchi, in consequence of the inflammatory thickening of their lining membrane and subjacent tissue. The natural intermittence of the rhonchus argues strongly against this notion, as the thickening of tissue must be a persistent state; and it is further opposed by the fact that either this variety of rhonchus or the sonorous may be interrupted and kept off for a variable number of respirations by causing the patient to cough. Coughing, we can readily understand, will alter the position of viscid mucus; but it cannot be supposed to have any direct and immediate influence on the thickness of the mucous membrane.

When the cause of the sibilant rhonchus is of a permanent nature, as diminished caliber from the presence of a tumor, it is said that the rhonchus is itself permanent. My own experience does not support this statement. I have in certain cases of the kind—few in number, however—discovered that the morbid sound will be altogether removed for a while by causing the patient to cough. This observation leads me to believe that in cases of this kind the altered form of the bronchus has less to do with the production of the rhonchus than the existence of local accumulation of viscid mucus, whether this be a mechanical result of the pressure of the tumor or the effect of circumscribed supersecretion. If this be correct, it is manifest that rhonchi of this class have no more claim in respect of their mechanism to the title of dry, than the crepitant or mucous: the impression made upon the ear, however, fully justifies the application of the term.

§ 156. (109.) The more marked coexistence of sibilant rhonchus with either inspiration or expiration, has been pointed out by M. Delaberge as distinctive of the size of the bronchi affected. If most marked in inspiration, the smaller bronchi are affected; if in expiration, the larger. This M. Fournet explains by supposing that the greater force of inspiration enables the air, during that movement, to cause the vibration of the smaller bronchi; while in the weaker expiration, force is wanting to produce the same effect.

§ 157. (109.) There is no affection in which sibilant rhonchus is so marked as in pulmonary emphysema, and it is here particularly and ex-

ceptionally distinguished by its generally being of much more intensity and duration in expiration than in inspiration. (*Vide* § 231.) In fact, when prolonged expiration is spoken of as a character of emphysema, the sibilant (or sonorous) rhonchus is often in reality referred to; for in aggravated cases this altogether supersedes the natural expiratory murmur: in such cases, indeed, respiration is little more than a continuous sibilant (or snoring) rhonchus.

But it would be an error to suppose that the dilatation of the vesicles (or rarefaction of the lung), which fundamentally characterises emphysema, is the sole cause of the rhonchus. The various amounts to which the rhonchus exists in the same person at different times, the manifest increase in the phenomenon brought about by attacks of catarrh, seem to show most conclusively that attendant bronchitis is the most essential condition of its production. I agree, too, with several observers in believing that a nervous or spasmodic state may have no small influence on its development.

§ 158. (109.) M. Fournet was, as far as I am aware, the first to describe, under the name of "dry cavernous rhonchus," a morbid sound produced under "those rather rare circumstances in which a cavern, altogether free from liquid; and somewhat dried on the internal surface, is, in respect of the air traversing it, in the same condition as the bronchi and trachea during the first stage of acute bronchitis." I do not perfectly understand what is meant by this phrase, but I believe that I have observed the fact referred to by this writer. He

describes the rhonchus as being of shrill or of grave tone (sibilant or sonorous), and differing from the the common dry bronchial rhonchi simply by its cavernous special character, and by its always accompanying both respiratory movements.

I have observed a dry rhonchus of sonorous type under the clavicle of a subject who had, on examination a few days before, presented in the same place the common signs of excavation,—a rhonchus so loud as to mask every other sound during respiration. It coexisted still with strong pectoriloquy, and had undoubtedly a more hollow or cavernous character than the common dry rhonchus produced in the bronchi; nevertheless I do not feel satisfied that the seat of this rhonchus is actually the cavity itself, and am rather disposed to believe that it is even under these circumstances a phenomenon originating in the bronchi, but modified in its character by the close vicinity of excavation. And, at all events, I do not believe that the sound could be produced in the cavity without the presence of some viscid material as a source of vibration, and which would necessarily deprive the cavity of the property of extreme dryness assigned to it by M. Fournet under these circumstances.

§ 159. (109.) Sibilant or sonorous rhonchus similarly attends dilatation of the bronchi sometimes: here the same observation is to be made as in the last instance, respecting the immediate seat and cause of the phenomenon.

§ 160. (109.) Laennec having observed that sonorous rhonchus sometimes exists in pneumonia, ascribed it to the compression of the bronchi by

indurated pulmonary tissue: MM. Barth and Roger more plausibly refer it to coexisting bronchitis.

The phenomenon is an extremely rare one, however. I have never observed it, except in the pneumonia of infants, in whom, as is fully ascertained, the coexistence of these two inflammations, or transition of bronchitis into pneumonia, are much more common than in the grown subject. Were Laennec's opinion respecting the mode of production of dry bronchial rhonchus in pneumonia correct, its occurrence would necessarily be very frequent, instead of being singularly uncommon.

Possibly the coexistence of dilatation of the bronchi may have some indirect influence, as previously alluded to, in the production of sonorous rhonchus in pneumonia; at least it is certain that the age at which the rhonchus is most common, namely, infancy, is precisely that at which dilatation of the bronchi is most common as an attendant on hepatization: this has been shown by the inquiries of Dr. Ogier Ward (*Med. Gaz.* 1838), and of MM. Rilliet and Barthez.

§ 161. (109.) According to some writers, sibilant and sonorous rhonchus are much less frequently heard in chronic than in acute bronchitis; and when they appear in the former, indicate a complication with acute irritation. I am disposed to coincide with these authors, but am not perfectly assured of the alleged fact. If real, it depends, in all probability, on the less viscidity of the secreted matters in chronic cases, in consequence of which humid rhonchi supersede the dry.

§ 162. (109.) Dr. Williams, who appears to

attach very considerable importance to the *size* of the tube in which the sounds are evolved, *independently of mucus obstructing them*, considers that the deep bass variety of sonorous rhonchus can have its seat only in the large tubes; but that as a more considerable obstruction may "flatten their caliber to the smallest size," these large tubes may also be the seat of the acute notes. In the practical notion here taught I perfectly coincide: the fact of the dry rhonchus possessing in a marked degree the *sonorous* character seems to justify our localizing it in the larger bronchi; but I do not believe that such effect occurs without vibration produced in, and being transmitted from, inspissated liquid matter contained in the interior of the tubes to their walls.

Dr. Williams endeavours also to refer the two forms of dry rhonchus to particular shapes of the constricted bronchi.

§ 163. (110.) The mechanism of the production of the *dry crackling* rhonchus remains unascertained, and it appears useless to state the notions which have been tendered on the subject.

§ 164. (110.) It is in the earliest stage of phthisis that the anatomical state mentioned in the table is of greatest importance, and during that stage, consequently, that the diagnostic evidence of the *dry crackling* rhonchus is the most desirable. But it must not be forgotten that the rhonchus may occur wherever and under whatever circumstances unsoftened tubercle in moderate quantity exists in the lung; it may therefore be audible in one spot, while at another the signs of softening or of excavation are present.

§ 165. (110.) The mechanism of the crepitant rhonchus is yet undecided, and its consideration implies that of certain phenomena themselves involved in obscurity.

Two principal points demand investigation: *a.* The intimate seat of production of the rhonchus; *b.* The physical condition of that seat at the moment of production. I shall state the opinions held by different auscultators upon these points, and the arguments upon which they are grounded.

a. The cavities of the pulmonary cells are the seat of the rhonchus; because—

1. The rhonchus is evidently a diminutive of the finer mucous bubbling rhonchus, which is confessedly produced in the smaller bronchi: the comparatively small size of the "bubbles" is explained by the less caliber of the cavities in which they are evolved. (Andral.)

2. The "bubbles" are exremely small, numerous, and equal in size, like the cells themselves. (Barth and Roger.)

3. In old subjects the "bubbles" are larger than in adults, and so the cells are of enlarged dimensions from the process of atrophy which the lung has undergone. (Hourmann and Dechambre.)

4. In infants, on the contrary, the "bubbles" are sometimes of extremely minute size, and in these subjects the cells of the lung are known to be proportionally small. (Barth and Roger.)

5. The shape of the "bubbles" appears to furnish an exact representation of that of the cells. (Dance.)

These arguments are not unanswerable. In the first the question is begged: the difficulty is to as-

certain whether the rhonchus *is* a diminutive of the mucous. 2. The sounds convey the notion of minute and of equal size, it is true; but this is no proof that they orignate in the cavity of the cells. 3. The alleged fact is probably correct, and is connected no doubt with the atrophy which commonly exists in individuals of advanced age; but this atrophy may be understood to modify the rhonchus, without the seat of this being necessarily admitted to be the interior of the cells. 4. Against the correctness of this statement I must express myself most strongly. I have never yet heard a crepitant rhonchus having as much of the character of minuteness in the infant as in the adult subject; and I should have supposed the non-development of the true primary rhonchus in subjects of very tender age a fact familiar to all auscultators. 5. The notion respecting the shape of the "bubbles" seems to be an illusion; and its want of import is rendered sufficiently obvious by the circumstance that the best imitation of the crepitant rhonchus is furnished by rubbing a lock of hair firmly between the fingers. The real existence of "bubbles" is similarly shown to be, at the least, a matter by no means proved by the *character* of the rhonchus.

For these reasons, I am disposed to believe that the development of the crepitant rhonchus in the *interior* of the vesicles may legitimately be questioned.

b. The passage of air through liquid contained in the cells is commonly believed to be the physical cause of the rhonchus; but writers differ respecting the consistence of the fluid. 1. Some maintain that

it is of aqueous or serous consistence, founding their belief upon the state of the liquid expressible from the lung after death during the first stage; and upon the fact that it is found experimentally, the more viscid the fluid through which air bubbles, the less perfect will be the similarity of the noise produced to the crepitant rhonchus,—to such a degree, that when pure mucilage is employed no crepitant sound is produced at all. (Spittal.) 2. Others maintain that the perfection of the crepitant character depends on the fluid through which air bubbles being viscid in a high or at least a notable degree. Dr. Williams observes, that "the character of the expectoration in pneumonia does not warrant the supposition that there is, during life, any other secretion into the air cells during the first stage than the characteristic viscid secretion of the mucous membrane which lines them." (P. 134.) Dr. Spittal's experiment, just referred to, he conceives deficient in applicability; because in it the air rises to the surface in consequence simply of its own lightness, whereas in the lung the air is forcibly driven through the viscous liquid by the force of inspiration. The serum found in the lung after death he ascribes to cadaveric separation from the blood contained in the vessels, because there is no serous expectoration in the first stage of the disease.

The tendency which each of these two sets of observations has to overthrow the other is sufficiently obvious. But there is a more cogent argument against the notion that the consistence of the secretion occupying the cells exercises material

influence upon the rhonchus; namely, that both the ordinary true crepitant and the exceptional subcrepitant rhonchi occurring in pneumonia coexist with expectoration of various degrees of liquidness or viscidity. Upon this point I perfectly agree with M. Grisolle, nor can I imagine that any one will be found ready to dispute the position.

It appears inferrible, from what has now been said, that the theories of the mechanism of the crepitant rhonchus hitherto proposed cannot be considered satisfactory: it is unfortunately easier to make this manifest, than to substitute a less objectionable one in their room. It seems to me most probable that, 1st, The phenomenon occurs in the parenchyma of the lung itself, especially in those portions of it immediately contiguous to, and actually forming the walls of, the ultimate terminations of the bronchi; whether these terminations be globular sacs open at one point of their periphery only, or otherwise constituted: 2ndly, That its physical cause is the sudden and forcible expansion of that parenchyma, glued together, as it were, by the viscid exudation with which it is infiltrated. Each single crepitus or click would thus signify the expansion of a cell, and be produced by the unfolding of surrounding glutinous tissue necessary for that expansion. Thus conceived, as respects its mechanism, the chief phenomena of the crepitant rhonchus become perfectly intelligible: its dryness and sharpness; the sensation of minute size attending the sounds of which it is composed; the similarity to the sound of minute ruptures of tissue, and the total absence of the bubbling character; its

occasionally accompanying the entire inspiratory act, and sometimes appearing only at its close, according as the infiltration of viscid lymph less or more completely prevents expansion of the vesicles. We can on this supposition also readily understand why crepitation should exist in inspiration only: though the rapid and abrupt unfolding of the glutinous mass be productive of crackling noise, it is very unlikely that the comparatively slow and equable restoration of the tissue to its previous collapsed state would be thus productive,—indeed the presumed physical cause of crepitus has ceased to exist. On the other hand, there is no reason why in the ordinary theory crepitation should not as regularly exist, though not with the same *loudness*, in expiration as in inspiration. The air is presumed in inspiration to have passed through a certain fluid; if so, it must repass through it during expiration, and assuredly with a noise similar in kind, though less in degree: when rhonchi are manifestly produced by the passage of air through liquid (*e. g.* mucous, cavernous, &c.), they attend both inspiration and expiration. For some further considerations confirmative of the views here taken, the reader may refer to § 97. and § 237.

§ 166. (110.) It follows, from the statement in the table, that the mean frequency of pneumonia in different parts of the lung must furnish a precise estimate of the frequency of the crepitant rhonchus in those parts. The subjoined figures therefore, though referring directly to the locality of the inflammation, apply by inference to the crepitant rhonchus. I would, however, observe, with respect

to the cases of double pneumonia, which hold a tolerably high numerical rank, that the great majority of them were not so from the outset; in other words, that the implication of the second lung was secondary in point of time. This, indeed, is a matter of no mean importance; for in doubtful cases the existence of the phenomenon at one only or at both sides of the chest, will aid materially in distinguishing the true crepitant rhonchus of pneumonia from the subcrepitant of capillary bronchitis.

Pneumonia of right lung in	742	cases.
left lung	426	
both lungs	262	
	1430	

Pneumonia of the upper lobe in	101	cases.
the lower lobe	133	
the middle part	30	
	264	(Grisolle.)

The frequency of double pneumonia in the above estimate is, even with the qualification above mentioned, probably exaggerated: accurate observers have found the proportion in adults only 1 in 17 (Grisolle), or 1 in 16 (Barth), of the total number of cases. In new-born infants, double pneumonia is infinitely the most common form. Of 128 cases observed by Valleix and Vernois, the locality was as follows: —

Pneumonia of right lung - -	17
left lung - - -	0
both lungs - -	111
	128

It is more common to find both organs affected in aged persons also than in adults.

§ 167. (110.) As the most common cause of symptomatic pneumonia is tuberculous disease of the lung, and as the most common seat of tubercle is the apex, it follows that this part will be, more frequently than other portions of the organ, the locality of the symptomatic species of the crepitant rhonchus. It has recently been stated by MM. Barth and Roger that when idiopathic pneumonia attacks the summit of the lung, its posterior part tends more frequently and earlier to become the seat of inflammation than the anterior; and from this they draw the corollary that "if crepitant rhonchus be audible at the summit of a lung, and *exclusively in front*, with coexisting febrile symptoms, there is reason to infer that the existing pneumonia is tuberculous."

With respect to the common seat of idiopathic pneumonia of the apex at the posterior part of the organ, my inclination was to coincide on the ground of memory with these observers; and I find that their statement is perfectly borne out by a reference to the cases of such pneumonia in my possession. This is scarcely to be wondered at, as some at least among them were observed in company with M. Barth in the wards of M. Louis. But I am not prepared to say from my own experience that pneumonic signs cannot be limited to the anterior regions for a time without being the result of tuberculous irritation; and I find that M. Grisolle, in his recent work, refers to two cases in which the physical evidence of pneumonia was for several

days limited to the infra-clavicular region, yet there was no satisfactory proof of the disease being of tuberculous origin.

§ 168. (111.) Auscultators are indebted to M. Louis for clearly establishing the frequency and the pathognomonic character of subcrepitant rhonchus at both bases, as a sign of capillary bronchitis. It is now well understood that the marvellous success obtained by certain French physicians in the treatment of "pneumonia" depended on their having taken what was in reality capillary bronchitis for the former disease, — the immediate source of their error being confusion of the subcrepitant with the true crepitant rhonchus. The existence of the sound at *both* bases or at *one* base only is of great utility in distinguishing the two species of rhonchus.

It might be inferred, from the localisation of the crepitant rhonchus, that idiopathic inflammation affects almost exclusively the bronchi of the bases of the lungs. But the greater frequency of the rhonchus in that situation depends most probably, as MM. Barth and Roger observe, upon the greater abundance of bronchial tubes in that situation, their greater length, and the direction of their course, all of which conditions favour the stagnation of fluids in their interior.

§ 169. (111.) Tuberculous subjects, the *apex* of whose lungs is also the seat of capillary bronchitis, are of course liable to be seized with idiopathic bronchial inflammation of both *bases* from accidental causes. Under such circumstances it is curious and interesting to observe the manner in which the upper and lower rhonchi travel towards each other, so as

eventually, in some rare instances, actually to meet towards the middle height of the lung. Where such extension of the rhonchi takes place, the case is of the most serious character.

I may observe, with respect to the symptomatic rhonchi occurring in connection with tubercle at the apices of the lungs, that I have found true crepitation, to say the least, singularly rare; that is, unless in cases where the cause of the rhonchus is really extensive pneumonia,—such pneumonia as shall during its existence assume, in point of importance, all the characters of the idiopathic inflammation. Under the ordinary circumstances of acute irritation setting up in the neighbourhood of the new matter, the subcrepitant is the rhonchus audible, and capillary bronchitis the anatomical state present.

§ 170. (111.) The mechanism of the humid crackling rhonchus is almost as obscure as that of the dry. It appears to me rather to be produced in *direct* connection with tuberculous matter which has commenced to undergo softening, than to constitute a mere form of bronchial rhonchus having its seat in the bronchi, and produced by bubbling of air through mucus. The clicking character it possesses, combined with the special nature of the anatomical conditions which it is known to attend, points to a peculiarity in its mechanism. Possibly it originates in the interior of softening tubercles which have just commenced to communicate with the minute bronchi. If so, its "conversion" into mucous rhonchus would in reality be nothing more than its being superseded by that state.

§ 171. (112.) A most interesting example of evacuation of pus from the pelvis of the kidney through the bronchi has been recently added by M. Rayer to the few similar ones already on record. (*Maladies des Reins*, t. iii. p. 313.) In this case a large mucous rhonchus, passing subsequently into the gurgling or cavernous, announced among other signs the perforation of the lung and entry of urine and pus into the bronchi.

§ 172. (112.) Dr. Stokes, some years ago, announced his opinion that the occurrence of interstitial suppuration in pneumonia might be detected with tolerable certainty by the coexistence of "a sharp and peculiar muco-crepitant rhonchus with bronchial respiration." M. Fournet has more recently described a mucous rhonchus, limited to inspiration, as indicating the same anatomical change. The experience of M. Grisolle on this point leads him to doubt the perfect accuracy of these statements; he admits nevertheless that the supervention of large humid crackling or actually mucous rhonchus, in a part of the lung which has for several days been the seat of blowing respiration unmixed with crepitation, will justify the physician in *suspecting* the occurrence of suppuration, *provided the general symptoms have at the same time undergone change for the worse.*

§ 173. (112.) It has been pointed out by Dr. Stokes that the agitation of the fluid in cavities produced by the action of the heart may be attended with a gurgling sound, or a "tick loud enough to reckon the pulse by." This sound may acquire a metallic character when the patient holds his mouth

open. It may occur in either lung. Dr. Stokes has heard it in the postero-superior portion of the right lung, while it is commonly absent even when the cavity lies upon the pericardium. (*Op. cit.* p. 407.)

§ 174. (112.) In extremely rare cases, a cavernous rhonchus is produced when a communication exists between a circumscribed collection of pus in the pleura and the bronchi. M. Chomel, it appears from the work of MM. Barth and Roger, points out the following means of distinguishing this peculiar case from that of an ordinary tuberculous cavity. In the latter, the cavernous rhonchus diminishes in proportion as the examination is made at a point more and more distant from its centre of production; in the case of the pleural cavity (for so it may be called), the gurgling produced inferiorly in the most common site of perforation is propagated upwards, and exists with its full force within a limited extent around. I confess it appears to me that this peculiarity, which is put forward as an essential character of tuberculous and of pleural cavity, depends merely upon the ordinary seat of those two kinds of excavation.

§ 175. (113.) The grating variety of friction sound is uncommon. In a case observed by M. Fournet, it was traced to a considerable number of small tuberculous granulations infiltrating false membrane, and slightly prominent on its surface. These granulations were not larger than a pin's head.

§ 176. (113.) Pleurisy is one of the most common of maladies; yet friction signs are far from

remarkable for frequency of occurrence, or at least of discovery. The following are the chief reasons of this comparative rarity:—

1. Liquid effusion generally occurs with great rapidity; the time during which friction signs are audible has therefore frequently passed by when patients apply for medical aid.

2. Friction signs may exist, but escape attention from their slight degree of development;—

3. Or from auscultation not being practised immediately over their seat of production;—

4. Or from too long a period being allowed to elapse between successive examinations of the chest.

5. In cases of absorption of pleuritic effusion, the development of redux friction sound will be prevented if there be general and regular adhesion between the two pleural surfaces; because locomotion of the lung is thus prevented. (Fournet. *Vide* § 102.)

6. In all cases of pleuro-pneumonia in which, while the infiltration and enlargement of the lung are sufficiently great to prevent its expansion, resolution of the pleurisy occurs before that of the pneumonia, pleuritic friction sound cannot be developed. (Fournet.) Dr. Stokes has also expressly noticed the rarity of friction phenomena in pneumonia: "in no case has he found them after hepatization had formed; and their coexistence with the crepitating râle in the early stages is extremely rare." (*Op. cit.* 471.) Under the circumstances stated in the table, however, pneumonia is sometimes attended with friction phenomena.

7. In some cases, friction phenomena are audible in pleurisy after deep inspiration, when perfectly imperceptible during ordinary breathing. The natural inclination of patients suffering from this disease to restrain the motions of the chest as much as possible, tends to deceive the observer as to the non-existence of friction sounds.

The statement that *pleural* friction sound may be produced by the motion of the heart is Dr. Stokes's.

§ 177. (113.) It has been stated by M. Fournet that the grazing sound is most commonly encountered at the upper parts of the chest, and indicates the progress of tuberculisation to the periphery of the lung. Since my attention was drawn to this point, upwards of two years ago, I have frequently and carefully auscultcd phthisical patients in the site of their local pains; but my results have not been quite in accordance with those announced by M. Fournet. In the first place, I have rarely succeeded in detecting grazing sound at all in the site of these pains; and when I have been successful, it has presented itself in the seat of pain felt at the antero and infra-lateral angle of the chest, and under the angle of the scapula. I have not yet satisfied myself of its existence either in the supra-spinata fossa, post-clavicular, or infra-clavicular regions: probably, as it appears to me, it is masked in these vicinities by the more marked physical signs usually present.

I infer from my own experience on the more common situation of this sign that, in opposition to the statement of M. Fournet, the pleurisy it denotes

is not usually dependent on actual extension of the tuberculous disease to the periphery of the lung. The phenomenon is of importance, because it has helped to connect the wandering pains of phthisical subjects with local and evanescent pleurisy; but my observation on the localities it occupies would lead to the inference that the cause of that pleurisy, though a dependence on the coexisting tuberculous disease, is not a direct consequence of the mechanical or vital irritation of the foreign matter. (*Vide* § 178.)

§ 178. (113.) As may be inferred from § 177., it is in phthisical pleurisy the grazing sound is most commonly met with. In primary idiopathic pleuritis it is very rarely to be detected, because the period of its existence has usually passed away before the patient is submitted to examination. In cases of intercurrent pleurisy, where the patient has been under treatment for the primary disease, a better opportunity is afforded of establishing its existence. Another source of difficulty in its detection, even in tuberculous cases, is the shortness of its duration: a single day suffices for its production, development, and termination; and this series of changes may, as I have, though rarely, observed, be accomplished several times successively in the course of a few days.

§ 179. (113.) The mechanism of friction sound is such that it is difficult to conceive its production where liquid effusion is present in the pleura; and ordinary experience is in accordance with *à priori* consideration — the two conditions are not *observed* to coexist. Dr. Stokes has, however, witnessed a

case in which, though great and universal dulness of the side existed, friction phenomena were audible, and even perceptible to the patient, in the postero-inferior and lateral portions of the chest: "they may then," he infers, "coexist with extensive liquid effusion." (*Op. cit.* p. 469.) But upon this it may be remarked, that supposing the case to have been at the period of absorption (and there is nothing stated in the text of Dr. Stokes to exclude the supposition), the fluid might have been nearly removed, and yet the condensation of the superficial strata of the lung, combined with an accumulation of pseudo-membranous matter, been sufficient to produce extensive and marked dulness. Now, under such circumstances, the production of friction phenomena — in a manner readily intelligible too — would have been almost inevitable. (Vide *Cycl. of Surgery*, art. "Empyema," vol. ii. p. 98.)

It is conceivable, however, that the retention of some portion of the lung's surface in tolerably close proximity to the costal pleura, by means of adhesions, *might* render the production of friction sound possible in a case where a considerable quantity of fluid was present in the pleura. M. Fournet states (p. 216.) that he once ascertained the co-existence of these three conditions.

§ 180. (113.) Laennec, as is well known, described friction sound as an attendant upon, and one of the most important diagnostic signs of, interlobular emphysema; while he made no mention of its existence in pleurisy. The experience of his followers has reversed the connection which Laennec sought to establish: it is now believed that emphy-

sema of any anatomical form is as incapable of producing friction signs, as pleurisy is indubitably their common cause. Andral, Louis, Stokes, Fournet, Barth and Roger, agree in denying, either directly or by inference, that the collision of subpleural vesicles, or of pulmonary septa rendered prominent by infiltration of air, against the opposite pleura, is an observed cause of friction sound. Such was the opinion which I held upon the point also; and I still believe that we want the anatomical proof of the phenomenon being thus generated. But from some cases I have lately met with of very advanced emphysema, manifestly attended with a low degree of rubbing sound at the postero-inferior part of the chest (where subpleural vesicles are very commonly developed), and presenting neither signs nor symptoms indicative of pleurisy, I am induced to think it at least possible that Laennec's belief respecting the occurrence of friction signs in some forms of emphysema was not wholly erroneous. Upon referring to certain cases in my possession of individuals dying with extensive infiltration of air under the pleura, I find the existence of friction sound during life noted, and certainly not a syllable respecting false membrane in the pleura among the details of the post-mortem examination. I can scarcely think that so obvious an appearance as this would have been forgotten had it existed. These cases too, I would observe, are the more deserving attention, because collected at a period when I had a preconceived notion against the possibility of friction sounds being evolved in the manner now referred to.

Dr. Stokes regards their evolution under the circumstances as physically impossible. "It is only," he observes, "when the surfaces are rendered dry by an arrest of secretion, or roughened by the effusion of lymph, that their motions produce sounds perceptible to the ear." (*Op. cit.* p. 194.) This remark is perfectly just, as observation and experiment prove, if applied to these surfaces when holding to each other their natural relation of simple approximation without mutual pressure; but it begs the question at issue when applied to pleural laminæ, one of which presents elevations on its surface necessarily productive of some slight pressure between the opposed surfaces.

§ 181. (113.) According to MM. Barth and Roger, tubercles deposited under the two serous laminæ, and forming resisting prominences on the surface of these, may give rise to manifest friction sound. I have never met with an instance where the sound was obviously traceable to the anatomical condition in question, uncombined with the deposition of pseudo-membranous matter within the pleural cavity itself.

§ 182. (114.) The harsh laryngeal respiration, with its cavernous quality, may prove, according to M. Barth, of much utility to the surgeon about to remove a tumor from the neighbourhood of the larynx, by guiding him to the precise situation of this organ, no matter how much it may have been detruded from its natural position by the surrounding morbid mass. I should have conceived that the laryngeal murmurs would have been too readily transmitted through the mass to admit of such pre-

cise localisation as M. Barth describes; but I am unable on the grounds of experience to question the accuracy of his statement, which if correct is a very important one.

§ 183. (115.) It is obvious that from whatever cause or whatever source blood escapes into the trachea,—tuberculous disease of the lungs, ulceration of the trachea or larynx themselves, rupture of aneurism into the air passages, &c.,—a large liquid rhonchus must occur in the larynx. Comparative auscultation of the chest may be had recourse to with much advantage to localise the lesion causing the rhonchus.

§ 184. (115.) The diagnosis of laryngeal ulcerations may, according to M. Barth, be carried to great precision by means of gurgling rhonchus: the point and side of the organ where they are most numerous and advanced will be indicated by the maximum amount of rhonchus. This, he states, is especially the case when the ulcerations are seated at the bottom of the ventricles.

§ 185. (115.) The gurgling rhonchus which occurs in certain cases of foreign bodies in the air-passages is the result of the secretion of mucus caused by their irritation. It occurs, as shown by Dr. Stokes, not immediately on the entry of the foreign body, but after it has been in the passages for some short time.

§ 186. (115.) Although difficult to describe, it is easy to understand the nature of the *flapping* rhonchus. If limited to the larynx, observes M. Barth, it is a sign of rather favourable augury, inasmuch as it shows the false membrane is not closely attached,

and is hence capable of being expectorated. If it be audible in the trachea and larger bronchi, the extent of disease thus shown to exist, of course renders the prognosis proportionally serious.

§ 187. (115.) This diminished resonance of the voice may in some cases be useful in corroborating the evidence of the other signs which distinguish the atrophous from the hypertrophous form of vesicular emphysema. It can, however, be scarcely relied upon as a sign; for though it never appears to occur in the hypertrophous variety (the actual solid addition to the substance of the lung in this form being sufficient to counteract the influence of the dilatation of the air-cells), and is so far negatively valuable, yet I must add that diminished resonance is not an invariable attendant on atrophous emphysema. The conditions of vocal resonance in these varieties of emphysema have not, so far as I have been able to ascertain, been examined by writers; and I confess I am not able to supply their deficiency in regard of explaining the occasional occurrence of a natural amount of resonance in atrophous emphysema.

§ 188. (116.) Vocal resonance is rarely suppressed altogether in pneumothorax; it is much more common to find it simply diminished to a greater or less degree. The extreme rarity of *simple* pneumothorax is, however, unquestionably one of the chief reasons why suppression of vocal resonance is so rare a physical sign.

§ 189. (116.) Their dilatation is not, in the case of enlarged caliber of the bronchi, the sole cause of bronchophony: the coexisting thickening of the

walls of the tubes, and the condensation, often attended with chronic induration of more or less of the pulmonary substance around, contribute materially to its production. It may, however, be the sole cause of the sign in its most highly developed form (pectoriloquy), as proved by M. Louis's case referred to at § 141.

I have given in the table the explanation of bronchophony usually assigned, as I confess I do not see any sufficient reason to renounce it, notwithstanding the opposition it has recently met with from Dr. Skoda of Vienna. This author doubts that the increased resonance which accompanies a hard compressed state of the pulmonary parenchyma depends on the increased conducting power of the intermediate substance, because bronchophony may cease temporarily to be producible in cases of hepatization (*vide* § 112.), and because in pleurisy the intensity of vocal resonance diminishes as the quantity of fluid increases. There appears here to be confusion between two things essentially different as conducting agents,—solidified lung and liquid. I am not aware of its having been ever taught that the latter would, as a medium of communication, increase the intensity of the sound. For a statement of the doctrine of Dr. Skoda, the reader may refer to a paper by Drs. Drysdale and Russell in the *Ed. Med. and Surg. Journal*, vol. lvi. p. 83.

§ 190. (116.) Bronchophony cannot be regarded as an ordinary sign of pleurisy with effusion. At the stage of effusion with dilatation of the chest all vocal resonance has ceased; but in the two earlier stages of effusion the laminar and the gravitating,

this phenomenon may be detected under certain circumstances. 1. In the immediate vicinity of the larger bronchi between the scapulæ, inside the ordinary site of ægophony, the resonance is generally bronchophonic. 2. If there be induration of pulmonary substance (superadded to the mere condensation from pressure), bronchophony may be sometimes very manifest posteriorly and internally; for example, where slight hepatization coexists with effusion. 3. Bronchophony may be detected, as long since shown by M. Reynaud in a part of the lung which had just given ægophonic resonance, by causing the patient to alter his position in such manner as to displace the pleural fluid from the spot under examination. (*Vide* § 191.)

§. 191. (117.) The precise thickness of the layer of fluid most favourable to the production of perfect ægophony cannot be either laid down as matter of observation, or satisfactorily calculated. Laennec states (p. 41.) that he has discovered this sign when there were not more than three or four ounces of fluid in the chest. The ascertainable facts are as follow:—At the earliest period of pleuritic effusion, when it is deducible from physical principles that the fluid is tolerably equally spread over the pulmonary surface, there is commonly rather a tendency to ægophony than actual ægophony present. (*Vide* § 192.) The lung is then—the inference arises—too slightly condensed, and the liquid accumulated too small in amount for the production of the phenomenon. It appears in fullest force during the period of gravitation, before any detrusion of the parietes has occurred, and consequently while the fluid is still moderate in

quantity, and at its upper part spread thinly over the pulmonary surface. With the increase of effusion it disappears altogether, to return again (ægophony redux) when absorption has reduced the liquid to a thin layer. (*Vide* § 220.)

The flattening which the bronchi undergo in consequence of the pressure of the pleural fluid has also probably some influence in the production of ægophony: the mode of resonance is such as might be anticipated from that altered shape of the vibrating tubes. It is not sufficient in itself for the production of the phenomenon; otherwise, as observed by Laennec, it would exist in cases of absorption with *contraction* of the chest, which is not the case.

Persons having shrill and cracked voices become the subjects of ægophonic resonance under circumstances which, in individuals with voices otherwise characterised, would only be productive of bronchophony. (*Vide* § 190.)

§ 192. (117.) The limited seat fixed in the table is one of the conditions which it is most important to ascertain as diagnostic of true ægophony. The ægophonic bronchophony traceable to a naturally shrill and tremulous character of the voice (§ 191.) would be thus at once distinguished from resonance actually caused by the presence of fluid in the pleura, inasmuch as it would exist in the highest degree wherever the dulness under percussion was most marked; that is, commonly at the base of the lung. Now ægophony does not exist where the dulness is greatest; far from this: such a quantity of fluid as is capable of causing very notable dulness will

almost inevitably (§§ 191. 220.) cause the disappearance of ægophony, if it have previously existed.

It has been matter of inquiry whether ægophony is produced precisely on the level of the upper border of the pleural fluid, or at a certain elevation of that fluid where it is of a certain thickness. The point is a difficult one to decide; but it appears to me that the condition of the respiratory murmurs and of the sound under percussion support the latter, the less commonly received view.

Exceptional cases are met with, however, in which the seat of true ægophony is more extensive. Laennec sometimes observed it over the entire affected side at the commencement of the disease. In two such cases he "ascertained, by examination after death, that this peculiarity depended upon the retention of the lung in partial opposition with the chest by means of pretty numerous adhesions, so that the lung became invested by a thin layer of fluid over its whole surface. In cases of this kind the sign in question is observable during the whole period of the disease." (Forbes's translation, ed. 2. p. 42.)

But there is another cause why at the commencement of pleurisy ægophony (when it does exist) should be more generally diffused than at any later period of the disease. This cause, which escaped Laennec, because he mistook the true physical conditions regulating the mutual influences of the lung and fluid, is the equable distribution of the effused fluid in a thin sheet over the entire pulmonary surface — laminar effusion. (See *Cyclop. of Surgery*, art. "Empyema," pp. 97. and 104.) Rarely, however, does the opportunity occur of observing pleurisy

precisely at the period when the condition described exists; and actual ægophony is then always more unusual than a state of exaggerated resonance partaking simply of the ægophonic character.

§ 193. (117.) Double pleurisy is extremely rare, more especially in non-tuberculous subjects (Louis); hydrothorax, on the contrary, frequently exists on both sides simultaneously. The discovery of ægophony on both sides would therefore aid the observer in distinguishing inflammatory from passive effusion.

§ 194. (117.) MM. Barth and Roger refer to a remarkable case observed by one of them at La Charité, proving that ægophony may be the result of considerable accumulation of fluid in the pericardium. A rachitic girl, aged 17, presented marked signs of pleuritic effusion,—evident ægophony, suppressed respiration, complete dulness of sound: on her death the lung was found pushed upwards by an enormous collection of liquid in the pericardium, filling the entire of the left side of the thorax. Dance is stated to have observed a similar case.

§ 195. (117.) In cases of pleuro-pneumonia, when fluid exists to the necessary amount in the pleura the bronchophony of hepatization becomes modified very usually by an ægophonic twang — broncho-ægophony; but it is extremely rare to observe, except under the circumstances next noticed, true ægophony in these cases.

Many years ago the apparently important discovery was made that true ægophony exists in some instances of simple hepatization: the observation was a correct one, but its discoverers generalised it

altogether too boldly. I have never yet detected ægophony of well-developed character as an attendant on simple inflammatory induration of the lung, unless the ordinary voice of the subject had somewhat of a shrill tremulous character. Hence this exceptional species of resonance is most frequently encountered in subjects, more especially women, of advanced age. I have been gratified by finding that M. Grisolle's experience (*Op. cit.* p. 242.) has led him to a precisely similar conclusion. It may further be remarked, that the bronchophony of hepatization may be given an ægophonic character by directing the patient to speak through the nose.

§ 196. (117.) Pectoriloquy possessing the properties described in the text is not to be detected in all cases of excavation in the lung. The conditions of the cavity most conducive to its production are, — moderate size; smoothness and density of its internal surface, hence absence of bands either traversing it or attached to its walls; emptiness; superficial position, and especially adhesion of its periphery to the parietes of the chest; thinness of that portion of its walls next the surface; and free communication with the bronchi.

Where, on the contrary, a cavity is possessed of flaccid irregular walls, is more or less nearly filled with muco-purulent matter, and deeply seated, with healthy lung interposed between it and the surface, the resonance opposite it will be simply bronchophonic, the pectoriloquous character being completely lost.

Deficiency of communication with the bronchi, also, will prevent its development persistently or temporarily, according as the obstruction is itself

permanent or dependent upon passing circumstances, such as accumulation of sputa in their interior. Large size of the excavation renders the phenomenon indistinct, as also very small diameter of the bronchi opening into it. Generally speaking, very small cavities do not give pectoriloquy; but exceptions to this rule are occasionally encountered.

Laennec observes, that where the number of fistulous openings by which a large excavation communicates with the bronchi increases, pectoriloquy becomes indistinct or ceases altogether. If a communication be set up between a cavity and the pleura, or if the contents of the former escape into the subcutaneous cellular membrane, the phenomenon of pectoriloquy disappears.

It follows very clearly from these facts that well-marked pectoriloquy must be frequently wanting in cases of caverns in the lungs, and that the other signs of destruction of pulmonary substance are much more trustworthy.

And it is inferrible from what has been said (§§ 115. 195.) respecting the occasional association of these phenomena and the assumption by any of them of the characters of the others, that (as has been taught by many observers, Dance, Reynaud, Fournet, and others) bronchophony, ægophony, and pectoriloquy are rather modified degrees of the same fundamental resonance running into each other by imperceptible gradations, than essentially distinct phenomena.

§ 197. (118.) It has been remarked by MM. Barth and Roger that the bronchial cough of pleurisy has some special characters. "The air appears to

traverse flattened tubes. The phenomenon is limited to the root of the lung adjoining the large bronchi, and appears to be produced at a distance from the ear when applied to the base of the thorax; whereas in hepatization it may exist in variable points, and extend even to the lower part of the chest, still retaining a manifest character of proximity." In a word, the cough has an *ægophonic* character.

§ 198. (118.) Few physical phenomena have been the subject of more close and repeated investigation in respect of their causes than metallic tinkling. It appears to result clearly, from experiments by Fournet, Bigelow, and others, that the cause of the phenomenon, under the ordinary anatomical conditions of its occurrence, — namely, in pneumo-hydrothorax with bronchial fistula, — is the slow and successive bursting of bubbles of air (transmitted through the liquid contained in the pleura from a fistulous communication with the bronchi) upon the surface of that liquid. But it is manifest that the explanation will not hold good in cases of simple pneumo-hydrothorax: another must be sought. Upon this point I would first remark, in conformity with all I have observed since my attention was drawn to the point by M. Louis, that such pneumo-hydrothorax is, at the least, singularly rare (*vide* § 41.): in the very great majority of cases apparently of this kind, a perforation either really exists at the period of examination and escapes notice, or has previously existed and been closed by adhesion. Admitting, however, the real occurrence of occasional cases of simple pneumo-hydrothorax, and of their being attended with metallic tinkling, we are

forced with Laennec to ascribe the phenomenon to precipitation of a drop of liquid from some height upon the surface of the general mass of fluid below; the precipitation being effected by the sudden change of the patient from the recumbent to the erect posture, in such manner that fluid adherent to, or lying in contact with the upper part of the chest, may be detached in consequence of its own gravity. Under these circumstances, it of course occurs only seldom; in fact only when the change of posture referred to takes place.

The anatomical condition of pneumo-hydrothorax with fistula necessary for the production of either of the two metallic phenomena is, that the fistulous passage shall open by a small orifice below the level of the surface of the liquid. And M. Fournet's experiments, supported by rational considerations, lead to the inference that the production of one or the other variety of metallic sound will depend upon the freedom and rapidity with which the escape of air through the fistula occurs. If it make its way from the fistula by rare, slow, and successive bubbles, tinkling will be evolved; if the bubbles be numerous and closely following each other, metallic resonance will be the result.

Perfect amphoric respiration and metallic tinkling do not usually exist in the *same breath:* the reason that one should commonly exclude the other follows very clearly from M. Fournet's experiments. Amphoric respiration is observed when a column of air of moderate diameter pours directly or almost directly, that is, without passing through any or a very thin layer only of fluid, into that portion of the

pleuritic cavity which does not at the time contain liquid. The condition of its occurrence will be, that the fistula open above the level of the fluid, or if below, very slightly below that level; whereas the condition productive of metallic tinkling is, the existence of an opening seated at some distance below the level of the fluid. But as the level of the fluid is in some cases capable of being changed with the position of the chest, and hence the relation of the fistulous opening to that level altered, it follows that the same opening may at one time be the source of tinkling, at another of resonance.

If the size of the opening increase much, according to M. Fournet resonance will take the place of tinkling; and *vice versâ*, if its calibre be diminished by obstruction with pseudo-membrane or otherwise. Both phenomena will cease if complete closure of the opening be effected.

That the metallic phenomena should be best heard in connection with coughing and speaking, is just what might have been anticipated: these acts require greater force of respiration than ordinary breathing, and are therefore capable of forcing air through a passage which would have resisted its progress under a less impulsion. Forcible and deep respiration will produce similar effects.

For further information on these questions, the reader may consult Fournet, *Op. cit.* p. 378., or Brady's translation, p. 211.; Barth and Roger, *Op. cit.* p. 204.; in whose volumes additional references will besides be found: also Bigelow, in *Brit. and For. Med. Rev.* vol. vii. p. 569.

§ 199. (118.) The most clearly marked and

intensely developed metallic tinkling I ever heard was chiefly audible under, and a little outside, the nipple: the case was one of tuberculous perforation.

§ 200. (118.) Dr. Williams states (*Op. cit.* p. 128.) that he has "heard metallic tinkling accompany both the voice and cough in a case of partial pneumothorax, in which there was neither liquid effusion nor perforation of the pleura." He appears to allude to that species of partial pneumothorax which he has connected with the absorption of circumscribed pleuritic effusion. (*Vide* § 125.)

§ 201. (119.) The tuberculous is almost the only affection in which this means of diagnosis has been commonly applied. If the heart's sounds be more distinctly audible under the right than the left clavicle, and if the excess be sufficiently marked to leave no doubt as to its reality in the mind of the observer, the circumstance, in conjunction with the locality of its existence, affords strong presumptive evidence of tuberculisation. Generally speaking, other signs of a more direct character are observed at the same time; but in certain cases of incipient and rather deep-seated tuberculous deposition, it is often a source of satisfaction to have this additional sign to apply to. Its absence would not, however, by any means impugn positive evidence of consolidation derived from other sources.

§ 202. (119.) I am not aware that the diminished intensity of transmission of the heart's sounds has yet been made a subject of study,—a fact which may be explained by the rarity of the circumstances under which such diminution can be ascertained,

and by the abundance of more direct diagnostic signs usually present in the maladies which may possibly be productive of it. For obvious reasons, this sign must be most readily ascertainable on the left side; and it is interesting to know that there its existence may sometimes be established. In a case of intense emphysema of the left lung (to which the disease was limited almost completely), and especially marked at the posterior aspect of the chest, I lately detected, much to my surprise, that the heart's sounds were considerably more distinct behind on the right than the left side. As there was no evidence of induration of the right lung, and as the sounds there were not louder than is sometimes observed in healthy individuals, the difference on the two sides could only be ascribed to diminished conducting power on the left. This sign, in the rare cases where it could be established, would appear to warrant the diagnosis of general emphysema of the substance of the lung in its deeper parts as well as on its suface,—a point of some importance, for diagnosis (as well as anatomical investigation after death) generally aims too exclusively at the detection of *superficial* emphysema.

§ 203. (119.) Dr. Stokes (*Op. cit.* p. 414.) was the first to draw attention to this sign. It is sometimes accompanied with bellows murmur, exists with but little consolidation, and is then ascribed by him to sympathetic irritation, being removable by leeching under the clavicle, or subsiding spontaneously after a copious hæmoptysis: further proof of its being thus caused is derived from its not existing in the heart, aorta, carotid, or opposite sub-

clavian. The pressure to which the artery is submitted from the indurated and commonly contracted lung is, however, its usual cause. Dr. Williams (*Op. cit.* p. 182.) has met with subclavian murmur in cases where there was no reason to believe tubercles were present.

§ 204. (123.) This diminution of sound under percussion in simple bronchitis is singularly rare; and when we reflect that considerable turgescence and thickening of the mucous membrane over a large extent of surface form part of the anatomical features of the disease, the usual clearness of the sound affords fair ground for surprise. The fact is an important one; as it will enable us to infer the idiopathic character of the disease, and conclude without hesitation that it does not depend upon or attend tuberculous deposition.

The diminution of sound produced by accumulation of mucus is chiefly observed at the base and posteriorly, and occurs more especially in subjects of debilitated constitution, or in those labouring under prostrating diseases—as, for example, continued fever—of which the bronchitis is only a secondary lesion. In these cases there is often some œdema of the lung, which takes its part in producing the diminished clearness.

§ 205. (123.) Dr. Stokes states that a "metallic resonance, somewhat analogous to the cracked-jar sound of cavities, but evidently more diffused," is discoverable (he does not say how frequently) in cases of bronchitis, particularly in the young subject.

§ 206. (123.) Dr. Stokes describes "distinct agitation of the muco-purulent secretion in the

tubes from the action of the heart" among the signs of bronchitis with abundant secretion. In a case observed by him, "each pulsation of the heart caused a corresponding sound or râle, continuing when the patient held his breath, and forming with the respiratory phenomena a distinct rhythm in the succession of sounds."

§ 207. (123.) As a general rule, the sonorous and sibilant rhonchi are most marked and constant in the early or dry stage of bronchitis; the mucous in the second, or that of secretion. But both orders of sound are frequently combined in the second stage; and in some cases secretion occurs so rapidly that mucous rhonchus is audible from the first.

§ 208. (124.) Of the two forms of dilatation of the bronchial tubes,—that in which a number of them are tolerably evenly increased in caliber through a great part of their extent, and that in which a tube is suddenly dilated into a globular sac of greater or less size,—the latter, as might be anticipated, has by far the greatest tendency to furnish the signs of cavities. The distinction of the two kinds of cavity may, unless in very rare cases, be determined by the following points:—1. The signs of excavation are in phthisis found at the apex; in dilated bronchi, towards the central part of the chest. 2. In phthisis the signs are constantly increasing in degree and in extent; in bronchial dilatation they may remain for months unaltered in both these respects. 3. Dulness of sound on percussion precedes the signs of cavity in phthisis; does not occur till after them in bronchial dilatation. (Stokes.) 4. Hæmoptysis is rare in cases of dilated

bronchi; and if it have existed to a large amount, may be esteemed almost to decide the question in favour of the tuberculous nature of the case. 5. Loss of flesh is rarely carried to such an extreme degree in bronchial dilatation as in phthisis.

§ 209. (125.) We are indebted to Dr. Williams for the description of this species of case; he ascribes the production of the lesion to the obliteration of the smaller and peripheric bronchi by the pressure of the pleural fluid in pleuro-pneumonia: in consequence of this obliteration of the smaller tubes, the larger ones bear the whole force of the inspired air, and suffer dilatation under it. Coexisting retraction of the side will disclose the nature of the case. (*Op. cit.* p. 99.) Dr. Corrigan has connected this species of dilatation with deposition of contractile exudation in the stroma of the lung; a state of the organ for which he proposes the name of *cirrhosis*. (*Dub. Med. Journ.* vol. xiii. p. 266. 1838.) Dr. Stokes had noticed that the bulk of the affected side may be diminished, but he ascribed it to atrophy of the air-cells.

§ 210. (125.) Dr. Ogier Ward some years since (*Med. Gazette*, 1838) published three cases of pneumonia occurring in infants, which tended to show that dilatation of the bronchi was a frequent attendant on that disease in subjects of the tender age alluded to; the more extended researches of MM. Rilliet and Barthez prove that this dilatation exists in either of its two forms in one fourth of children from ætat. 1 to 16 dying of pneumonia. M. Grisolle ascribes the dilatation rather to the capillary bronchitis which in the majority of cases

precedes or accompanies infantile pneumonia, than to the parenchymatous inflammation itself; because M. Fauvel has found general bronchial widening in all children cut off by capillary bronchitis.

§ 211. (124.) I have, however, recently met with a most interesting example of extensive and general dilatation of the tubes in a child aged twelve, in which the vocal vibration was at the least not increased above, perhaps slightly diminished below, the natural standard.

§ 212. (126.) The conditions of the respiratory movements of emphysematous patients here described form a most important part of the physical evidence of the disease. Both the inspiratory and expiratory motions are laborious: the former less so than the latter, but yet to a very considerable amount; because the chest, not having been emptied of its contents by the previous expiration, is with difficulty further dilated.

§ 213. (128.) It would be more strictly in accordance with observation to say here increase of the muscular motions naturally producing expansion and elevation; for expansion especially is effected to a very slight amount only during the continuance of the paroxysm.

§ 214. (128.) This is a very delicate sign, and one which I have frequently failed in satisfactorily detecting under the circumstances. The possibility of there being always a slight degree of emphysema present in cases of asthma mainly spasmodic, is perhaps the real reason of the sign being seldom to be detected.

§ 215. (131.) The negative result of percussion

in lobular pneumonia is no more than might be anticipated, when we consider that the nodules of consolidated lung are separated by tissue perfectly permeable. In some cases originally lobular, I have found the sound duller than natural, it is true; but when this was the case, and the opportunity of examining the parts occurred, I invariably discovered such extension of the inflammation between the nodules as to reduce the organ, physically speaking, almost to the state of ordinary consolidation.

§ 216. (132.) M. Grisolle refers to a case observed by M. Requin, which appears to show that the physical signs in chronic consolidation may be different from those described in the text — in fact all of them negative: total absence of all healthy or morbid respiratory murmurs, of rhonchus, of vocal resonance, the sound at the same time being completely dull. In the case referred to, the affection was mistaken for simple pleuritic effusion; but the patient dying in a state of marasmus two or three months after the outset of the affection, the sole morbid condition discovered in the chest was very firm (non-granular or tuberculous) induration of the lower lobe of the right lung. I am unable to understand the peculiar physical phenomena of this case on the supposition that it was correctly observed and reported.

In cases where the affection principally implicates the upper lobe, and where the contraction of the exudation-matter thrown out into the substance of the lung has been active, flattening of the infra-clavicular region will take place. Under these circumstances,

especially if, as sometimes is the fact, among the general symptoms are those of emaciation, slow fever, &c., the distinction of the case from tuberculous consolidation is extremely difficult — impossible, indeed, unless by the aid of repeated examinations at certain intervals of time. The comparatively stationary condition of the part in simple consolidation associated with the progress of the general symptoms, if it do not perfectly explain the nature of the case, will at least point to the necessity of a cautious diagnosis. Fortunately cases of the class now especially referred to are of singularly rare occurrence.

§ 217. (143.) A few words in explanation of the varieties of effusion admitted in the text seem called for. While the liquid accumulated is moderate in quantity, this is found (where the physical principles carefully considered by Carson and Woillez would prepare us to find it) equally spread over the entire pulmonary surface (*laminar effusion*). This disposition of the fluid will continue so long as the aspiration of the lung exercises a more active and effectual influence upon its position than its own gravity. With the continuance of effusion the force of gravity becomes predominant, and the fluid accumulates at the most depending part of the chest (*gravitating effusion*). The duration of the first stage is of course mainly regulated by the rapidity of effusion; but is also to a less degree affected by the amount of elastic contractility of the lung. So far no alteration in the form of the chest is discoverable; because, as M. Woillez has well pointed out, the fluid has not accumulated to

such extent as to destroy the elasticity of the lung completely; and as long as any share of this force remains in action, mutual pressure of the thoracic walls and lungs cannot arise. But with the increase of fluid the lung is ultimately reduced to its *positive* volume, and is incapable of retreating further before the accumulating fluid; this consequently acts upon the thoracic parietes, and the phenomena of dilatation (*effusion with dilatation and detrusion*) commence. (Vide *Cyclopædia of Surgery*, art. "Empyema.")

§ 218. (144.) At this period, in consequence of the gravitation of the fluid, the upper part of the chest recovers in a great measure, or even completely, its normal sonorousness: hence a diminution of the extent over which dulness is perceptible actually announces increase of the disease. Though rare, we have observed a few examples of this occurrence: practically it is of much importance, for it might easily betray the observer into a belief that absorption had commenced. The inferior part of the chest of course sounds duller than before; but at first this increase is not strongly marked.

§ 219. (145.) Numerous modifications of the physical signs arise in consequence of adhesions between the costal and pulmonary pleuræ, the precise characters of those signs in each case varying with the number, form, and mode of attachment of the adhering tissues. The general character of the modifications thus induced is, that wherever an adhesion exists, the respiratory murmurs are of the diffused blowing type (often sufficiently marked to suggest the idea of hepatization), and strong circum-

scribed bronchophony exists within the same limits: in other words, the signs of condensation are present. The signs derived from yielding of the thoracic parietes, and from detrusion of the viscera attending the progress of effusion, are in such cases the main safeguards against errors of diagnosis. But it is not in these cases of adhesion only that blowing respiration may be an attendant on pleuritic effusion; it may be present where no adhesion exists, and the cause of its occurrence under these circumstances appears to me as inexplicable as it has proved to others. It does not, as far as I have seen, pass into the tubular variety under these circumstances.

§ 220. (146.) Although the rule is, with respect to ægophony, that it diminishes and disappears with the increase of effusion, yet cases do occur in which it remains in spite of very abundant accumulation. I have seen such cases, and such a one has been published by Andral (*Clin. Méd.* t. ii. Obs. xxi.), where displacement of the diaphragm and heart gave evidence of the abundance of the fluid.

§ 221. (149.) The following varieties of position of the heart in cases of absorption with retraction have been observed:—1. The organ having slowly or rapidly, gradually or suddenly, retraced its steps, recovers either its natural situation, or the immediate vicinity of this: here is the most common case. 2. It remains in the abnormal position into which it was forced by the effusion, in consequence, probably, of the establishment of adhesions. (Vide *Cyclop. of Surg.*, art. "Empyema.") 3. Dr. Stokes

has made the following curious observation in a subject who recovered from empyema of the left side. From the time of recovery this person observed that, "whenever he turned on the right side the heart seemed to fall over and pulsate at the right of the sternum. This curious phenomenon still (three months after recovery) continues. In the erect position the heart occupies a situation midway between the usual position and the sternum; but when he turns on the right side, immediately the pulsations can be felt to the right of the sternum, whilst they cease at the left side. The sound on percussion, too, varies with the position of the heart. In this case there can be no doubt that the mediastinum, stretched by the empyema, has not recovered its tone, and permits by its extension this extraordinary change of the situation of the heart." (*Op. cit.* p. 510.) 4. In certain cases of empyema of the right side the heart has been observed to be drawn, during the progress of absorption, into the right division of the thorax. This mode of displacement is probably more common than has been supposed. Dr. Stokes, who was the first to publish an example of it, lays considerable stress upon rapidity of absorption as a condition of its occurrence.

§ 222. (148.) In a subject whose chest I have figured elsewhere (*Cyclop. of Surgery*, art. "Empyema"), the distance from the nipple to the middle line was an inch and a quarter less on the affected than on the sound side. I have found a deficiency of three quarters of an inch between the nipple and iliac spine, and of half an inch between the twelfth

rib and that spine in other cases. Now, as respects these two latter measurements, if flattening of the contracted side may to a certain extent explain the deficiency in the first of them (on the supposition that the spine of the ileum on the diseased side is, as Laennec appears from his drawings to have believed to be the fact, lower than its fellow), it can scarcely be considered to account for that in the second of them: indeed, according to my own experience, the influence of the contraction does not extend to the pelvis, which has appeared to me equally high on both sides.

§ 223. (151.) Dr. Ogier Ward points out the facility with which the splashing sound may be produced as indicative of the consistence of the fluid: the thinner the liquid, the more easily is the gurgling noise produced.

§ 224. (151.) The almost precise similarity of the signs of pleurodynia and of the dry period of pleurisy is no more than we might expect, from the consideration that pleurodynia is the real cause, during that early stage of pleuritic inflammation, of any departure from the natural state of respiration. Unfortunately the grazing variety of friction sound, which belongs to pleurisy, is rarely to be seized. When the nature of the pain, the constitution of the subject, the absence or presence of cough fail to guide us, the progress of the case should be watched for a while before a decided opinion on its nature is hazarded. The combination of pleurodynia with slight bronchitis is one of exceedingly difficult detection.

§ 225. (139.) The diagnosis of acute phthisis,

notwithstanding the inquiries of M. Louis, Sir James Clark, Dr. Stokes, and M. Fournet, still requires much investigation. Dr. Stokes has broadly stated the principle of diagnosis to depend on "progressive, general, though not complete dulness, consequent on the signs of bronchitis;" but although generally so, these are not always the signs of the affection,—bronchial rhonchi may be wanting. "The continuance of the symptoms despite the remedies employed," observes Sir James Clark, "*together with the absence of those symptoms which characterise the common acute diseases of the chest, will greatly assist us* in the diagnosis of the early stage of this variety."

§ 226. (132.) This general principle is of very great importance; the rapid course of the disease, and the seat of the signs of excavation (generally at the lower parts of the lung), will also aid in distinguishing the case from one of tuberculous cavity.

§ 227. (132.) This condition of the note elicited by percussion will especially be observed, if the abscess be superficial.

§ 228. (133.) Laennec in describing the signs of pulmonary abscess forgot, or possibly was not aware, that the purulent matter might be retained in the seat of its formation, and has consequently taught that the signs of excavation invariably follow abscess. It is now, however, well understood that the walls of a purulent collection are not always immediately formed of pulmonary substance with bronchi opening upon them; but that the pus may be cut off from the surrounding tissues by a pyogenic membrane. Nor is this very rare. M. Grisolle

and some of his friends found it in three out of five cases; and the former in particular submitted the lung to insufflation, without being able to detect the smallest communication between the abscess and the bronchi. Under these circumstances observation carefully conducted has proved, as might have been anticipated, that the signs of cavity are altogether wanting.

§ 229. (133.) In a case of superficial subpleural pulmonary abscess with apparently complete retention of its contents, M. Bouillaud discovered on percussion over the collection what he terms a "*quasi* cracked-metal tinkling." If the collection had really no external communication by the tubes, this *quasi cracked-metal* sound must have been the *tubular*, with which, I know, it is constantly confounded in the French hospitals. An accumulation of pus would no doubt have the same effect, in conveying the tubular note from the bronchi, as a mass of indurated lung. (*Vide* § 41.)

§ 230. (133.) The rarity with which gangrene of the lung originates in acute sthenic inflammation is now generally recognised. Of 305 cases of pneumonia analysed by M. Grisolle (*Op. cit.* p. 345.), not one terminated by gangrene; and of 70 cases in various journals perused by him, five only could be considered positive instances of this mode of termination of pneumonia.

§ 231. (126.) This condition of respiration occasionally observed in emphysema appears at first to furnish an exception to the general statement already made (§ 59.), that the expiratory murmur is never absent *alone* as a *morbid* condition. The ex-

planation is easy. In the cases now referred to the respiratory murmurs are really both of them suppressed; but a sibilant rhonchus, inaudible in expiration, attends inspiration, and is liable to be mistaken for a modified inspiratory murmur.

§ 232. (140.) I use the term cancer here, because in the great majority of cases in which tumors have been met with in the chest they have proved of cancerous nature. It is obvious, however, that the physical signs can only be those of tumor — the diagnosis of *cancer* depending upon the symptoms (hæmoptysis among the most important), and the coexistence of cancerous growths in other parts of the body, &c.

§ 233. (140.) Although a careful comparison of the signs given in the text will enable the physician in almost all cases to diagnosticate the existence of considerable accumulation, and at the same time to determine that it can be neither liquid, tuberculous, nor pneumonic, yet it is fortunate for the facility of diagnosis that several other circumstances not strictly belonging to the category of physical signs, but more or less distinctive of the malady, are, as experience shows, to be commonly detected. The chief of these are, 1. Enlargement and extreme congestion of the jugular, axillary, mammary, and superior epigastric veins; 2. A notable difference in point of fulness between the two radial pulses; 3. Œdema of the affected side, corresponding arm, and side of the face; 4. Fulness of the neck; 5. Prominence of the eyeballs, which, combined with the condition of the neck and face, gives the patient the appearance to a certain extent of a

strangled person; 6. Dysphagia; 7. The existence of tumors in other parts of the body.

As these conditions (with the exception of the last) are the mere results of pressure, it is obvious that they are liable to vary or be absent altogether, according as the morbid growth does or does not press in particular directions. Nevertheless, as already mentioned, they are constantly present in greater or less number; and when they are so, associated with the physical signs, they leave no doubt as to the existence of tumor.

Infiltrated cancer of the lung, without tumor to such extent as to dilate the side, can only by possibility be confounded with pneumonic or tuberculous consolidation and pleuritic effusion. From these maladies it distinctly differs in the following particulars: —

1. *From pneumonic consolidation* it would be distinguished by — *a.* The retraction of the side (a phenomenon never encountered in a state of hepatization, so complete as to give rise to the extensive dulness and blowing respiration met with in cancerous infiltration); *b.* The total absence of crepitant rhonchus before softening, and the large mucous rhonchus present after softening, — a rhonchus not to be confounded with that attributed by some observers to the suppurative stage of pneumonia (§ 172.); *c.* The extension of the dull sound under percussion beyond the median line; *d.* The absence in many cases of fever; *e.* The absence of the characteristic rusty sputa of pneumonia.

2. *From tuberculous consolidation* by — *a.* The signs of extensive consolidation being unattended with

rhonchus of any kind; *b.* The absence of disease of the other lung frequently observed in cancer, seldom or never in phthisis, where one organ is very extensively affected (Taylor). After softening of cancerous matter, the diagnosis (provided the case had not been seen before that occurrence) must rest upon the signs of obstructive pressure coexisting with those of consolidation and softening.

3. *From pleuritic effusion* by—*a.* The absence of signs of expansion, and the depressed state of the intercostal spaces: in pleuritic effusion of sufficient abundance to cause the intense and extensive dulness of cancer, the chest would be more or less dilated, and the intercostal spaces rendered prominent; *b.* The intensity of the blowing respiration, and the great extent of surface over which it is heard. (*Vide* § 236.)

§ 234. (141.) The signs of softened cancer of the lung are here given from the only two cases in which, as far as I am aware, that condition has been observed during life,—those of Dr. Taylor (*Lancet*, March, 1842), and of Dr. Stokes (*Dublin Journal*, May, 1842). In the latter case, the phenomena were complicated by the signs produced by a collection of air between the pulmonary pleura and the substance of the lung.

§ 235. (141.) Depression of the liver in cases of infiltrated cancer of the lung without notable tumor has not often been met with: its existence will aid the observer in distinguishing the case from pneumonic and tuberculous consolidation, but will increase the similarity of the signs to those of pleurisy. In Dr. Taylor's remarkable case, the

organ was not displaced,—a fact which that observer availed himself of in determining, as he did, the diagnosis of the affection.

§ 236. (141.) The class of cases of tuberous cancer with dilatation of the side can manifestly be confounded only with those of very extensive pleuritic effusion. Cancerous accumulation of this amount will be distinguished by—*a.* The invariable absence of simple fluctuation in the pleura, and in all probability, even in cases of the most diffluent encephaloid, of peripheric fluctuation; *b.* The intensely marked resistance of the walls under percussion,—such that I have found it actually almost painful to use the finger as a pleximeter; *c.* The intensity of the blowing respiration, and the great extent of surface in which it is audible; *d.* The total absence of ægophony, which *may* be present in cases of even very abundant pleuritic effusion (*vide* § 220.); *e.* The intense bronchophony commonly discovered; *f.* The unnatural distinctness of transmission of the heart's sounds; *g.* Occasionally the existence of pulsation, palpable and audible, in the cancerous lung. Add to these marks of distinction the evidences of pressure on the œsophagus, vena cava superior, &c., above enumerated (*vide* § 233.), and the points of difference will be found sufficient, in the great majority of cases, to preclude the apprehension of error.

In some cases the amount of dilatation of the side is so great as in itself to make its dependence on fluid accumulation a matter of doubt; at least I have never witnessed such enormous enlargement from pleuritic effusion as existed in the instance of a boy

affected with encephaloid cancer of the right pleura, whom I saw under the care of M. Louis in the winter of 1834.

It is important for the practitioner to be aware that cancer of the lung is far from being an affection of such uncommon occurrence as is generally supposed; and careful study of the valuable papers on the subject, by Drs. Cowan, Stokes, Hughes, and Taylor cannot be too strongly recommended.

§ 237. (111.) I have recently observed the following facts, which appear to me worthy of notice, in respect of the subcrepitant rhonchus more particularly, but also of the mechanism of rhonchi generally. In a subject presenting the most evident signs, both in front and behind, of a cavity at the left apex, an extremely abundant subcrepitant rhonchus occurring almost in puffs, and having the liquid character in a most marked manner, was day after day (during the week previous to death) detected in the entire height of the left side posteriorly. The rhonchus was, however, distinctly more abundant and more liquid (as noted in writing during life), in the upper scapular and upper part of the lower scapular regions, than elsewhere. As the patient was anasarcous to a high degree (the urine albuminous), and as he constantly lay on the left side, the explanation of the subcrepitant rhonchus naturally suggesting itself was, that it depended on œdema of the pulmonary tissue generally, but most marked at the apex, and there of course affecting tissue between the cavity and the surface of the lung. At the post-mortem examination, however, I found this explanation was inadmissible; for the thin lamella of tissue between

the cavity and the surface was as hard as cartilage, and contained not a particle of serosity; nor was the organ in any part distinctly infiltrated with fluid, being, on the contrary, particularly dry from its excessive induration. But all along the posterior surface of the pulmonary pleura, there appeared (in addition to ordinary dense pseudo-membrane) a quantity of fine adventitious cellular tissue, abundantly infiltrated with liquid. Masses of some size were formed from place to place by the accumulation of fluid in the meshes of this cellular tissue, and it was observed by those present (who had not seen the patient during life) that they were much larger than elsewhere at the apex. There was no air either in the cavity of the pleura, or intermixed with the serosity. Now, although it is possible to suggest another explanation, it seems most reasonable to suppose, under the circumstances, that the rhonchus was actually produced in the masses of infiltrated tissue referred to, and therefore outside the lung, and independently of air. If such were the fact, it would lend much indirect support to the theory already (§ 165.) advanced in explanation of the true crepitant rhonchus.

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